THE ELECTRICAL WORLD

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Long Distance Telephony.

THE experiments lately made with various forms of telephone transmitters between New York and Cleveland and between New York and Chicago have attracted considerable attention both from the public and from scientific men. As usual, the reports of the tests and of the results attained, as published in the daily papers, have been anything but reliable. The matter being one of considerable interest to electricians, we take pleasure in presenting herewith an account of just what was accomplished on that occasion, with illustrations and descriptions of the several instruments used.

The wire over which the experiments were conducted was the large compound wire nearly completed between

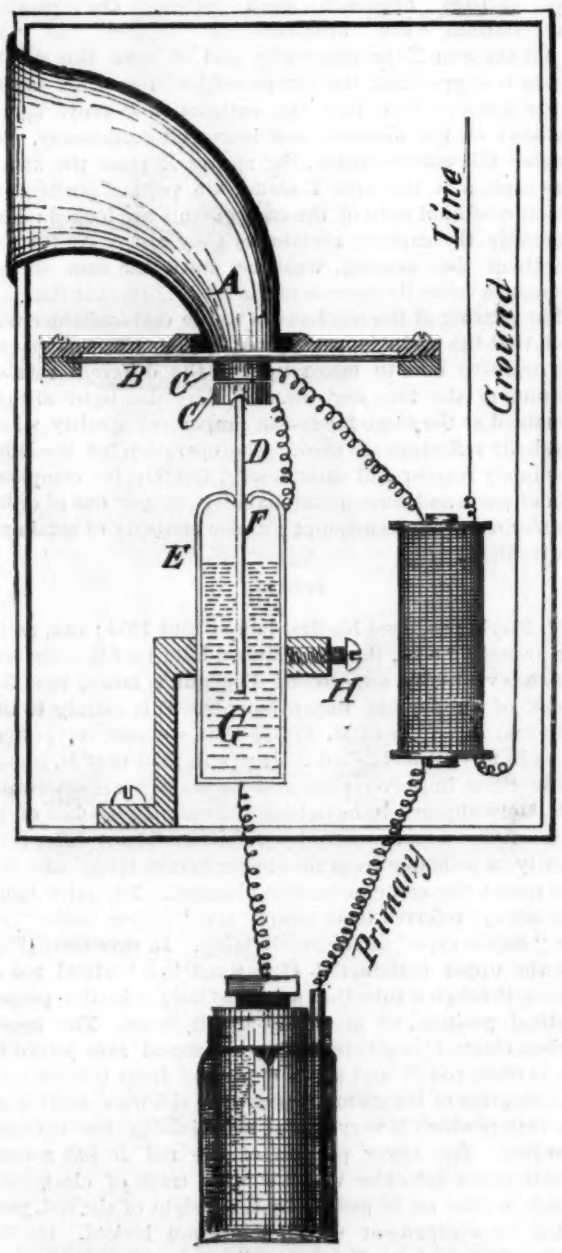


FIG. 1.—HOPKINS' MICROPHONE TRANSMITTER.

A, curved mouthpiece. *B*, diaphragm. *C C*, carbon buttons. *D*, plunger. *E*, iron cup. *G*, mercury. *H*, adjusting screw. Shape of box, oblong.

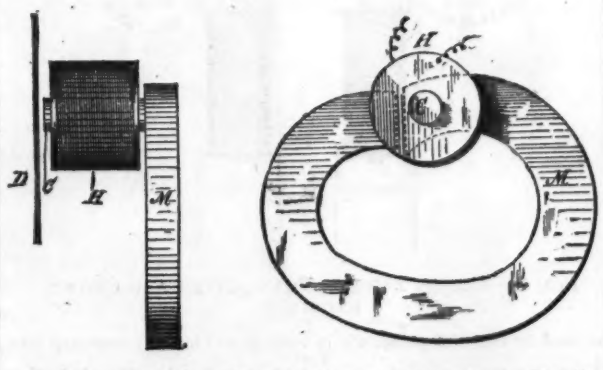
New York and Chicago by the Postal Telegraph Company, and which of itself is a marvel of perfection for such a purpose. Having a resistance of less than two ohms to the mile, and being clear of all other wires throughout the entire route, this line presented facilities for long-distance telephony and telegraphy that have never heretofore been available. For telephonic experiments, especially, it may be called an ideal line.

It is not the purpose of this article to criticise the different telephones (of which there have been eight or ten) that have been used in these experiments, but merely to give an impartial account of the work done by them.

When the wire was connected through to Cleveland, one of the first things that suggested itself to the minds of those in charge of it was to try a telephone and see whether articulate sounds could be heard. An old Edison transmitter was unearthed at Cleveland, and a common Bell receiver was all that could be procured on short notice at the New York office. It so happened that Professor Elisha Gray was present at the Cleveland end, and was, in fact, deeply interested in the experiment, as it was to verify or disprove a prediction that he had made long before, that the telephone would talk from New York to Cleveland or Chicago. After several unsuccessful efforts on the part of the gentlemen at Cleveland to make themselves heard at New York by talking into the transmitter, an attempt was made to talk to Cleveland through the hand telephone. The "hellos" were plainly heard and counting or constant repetition of some word or words could be made out, but the experiment could not be called successful, owing to the imperfect means at hand for making it. The remarkable fact, however, was demonstrated that sounds could be heard over 650 miles of wire through an ordinary hand receiver, and all present felt that, with proper instruments, conversation could be carried on over this circuit. A day or two later a Blake transmitter was tried, but no good results were obtained with it.

The next trial was made with a transmitter invented by Mr. H. F. Lufkin, that is said to have talked successfully over 200 miles of iron wire. This instrument was, after several tests, made to talk with Cleveland, but no description can be given of it, as the inventor refused to show how it was constructed.

An instrument belonging to the People's Telephone and



D, diaphragm. *C*, core. *H*, helix. *M*, permanent magnet. *H*, helix. *M*, permanent magnet. *C*, core.

FIG. 2.—FORM OF GOWER-BELL RECEIVER, WITH DIAPHRAGM REMOVED.

Telegraph Company was then tried, and from the first experiment it worked successfully. The speaker's voice could even be recognized, and prolonged conversations were repeatedly carried on with persons in Cleveland. As this was the first really good work that had been done, much interest was awakened in the experiment, and a number of inventors presented themselves, each with an instrument that he claimed was the best, and each obtained results that were perfectly satisfactory to him. As above-mentioned, however, it is not our object to criticise any of the work, further than to say that the Hopkins transmitter, the Baxter, the Secret, the Molecular, and two or three others not so well known, were each tried in turn, and while some, perhaps, did better than others, all of them did good work.

When the wire was completed to Chicago, there happened to be a Hopkins transmitter in the New York office, and the very first experiment made, after measuring the resistance of the wire, which was found to be only 1,522 ohms, was to telephone to Chicago through that instrument. While the talk was not by any means plainly heard, it was still good enough to get the counting hellos, etc., and when the nearly as familiar "Mary had a little lamb" was repeated two or three times, the gentleman at the western terminus reported back by telegraph that he had received it. He had no other instrument but a Bell receiver, but when he shouted into it his voice could just be heard in New York. After this experiment, all doubts about talking to Chicago vanished. It should be stated that there were about four miles of No. 8 iron wire in the circuit through the city of Chicago.

A few days later, double Edison transmitters were tried between the Union Stock Yards and this city, and prolonged conversations were carried on nearly every day for a week or more. The Secret, Molecular, and Hopkins transmitters were again tried over this great distance, and conversation was easily carried on with the aid of each of these instruments, as well as with the double Edison.

The construction of the Hopkins telephone is shown substantially in Figs. 1 and 2. The device as used at these tests consisted of an iron cup, about three inches in length and one inch in diameter, holding a certain amount of mercury, while into the mercury was placed a stick about the size of a lead pencil and about four inches in length. This stick, which is known as "the plunger," had a wire through its entire centre, the ends of the wire protruding from each end of the stick. One end of the stick is inserted in the mercury, the extended wire making electri-

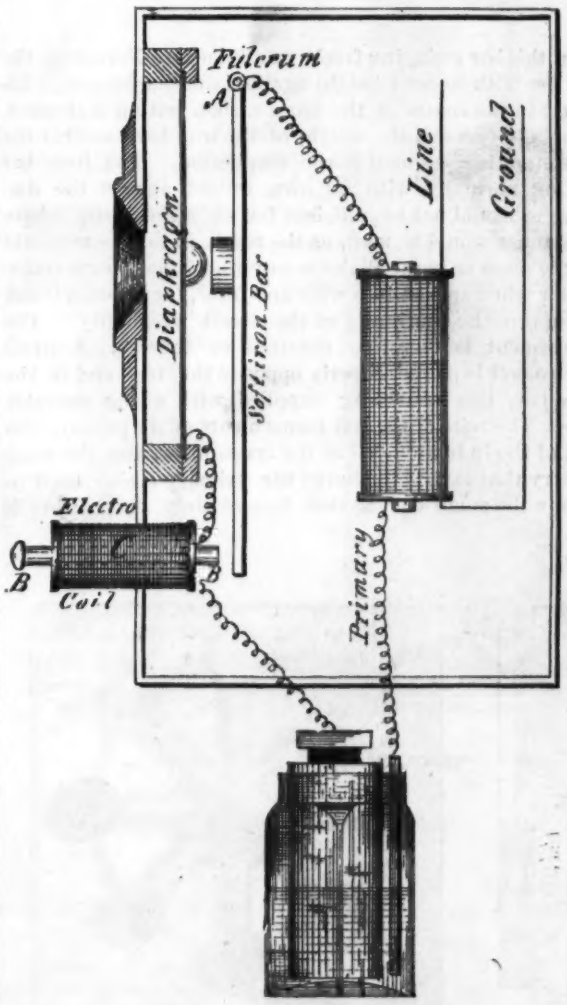


FIG. 3.—BAXTER MICROPHONE.

A represents the fulcrum, from which is suspended the iron bar, with carbon button in its centre. *C* is the small electro coil, and *B* the movable cone for creating field for iron bar. The form of the box is circular, otherwise diagram represents actual arrangement of parts.

cal connection with the mercury. The other end of the stick, or "plunger," carries a flat, smooth carbon button, about half an inch in diameter and a quarter of an inch thick. The other conditions are a diaphragm with a carbon button similar in size and shape to that resting on the end of the "plunger." The adjustment is obtained by carrying the iron cup upward until a contact is obtained with the two carbon buttons, the mercury responding freely and rapidly to the vibrations of the diaphragm, making a sensitive microphone. The mercury, being naturally yielding and elastic, permits the floating electrode to move freely with the diaphragm, simply taking the place of a spring, as is usual in the "Blake" and other forms of the transmitters or microphones of this class. In connection with the microphone an induction-coil is used in the usual man-

ner. The well-known Bell receiver and the Gower-Bell receiver (Fig. 2) were used.

We come next to the Baxter telephone, of which much has been said and of which little is known, as the patent has not yet been issued. Its general construction is substantially as follows (shown in diagram, Fig. 3).

To the diaphragm used a small round piece of platinum is made fast. The diaphragm itself is secured in a similar manner to that of the Blake transmitter, namely, with two stiff pieces of spring or spring fingers. Directly over the face of the diaphragm is suspended a bar of soft

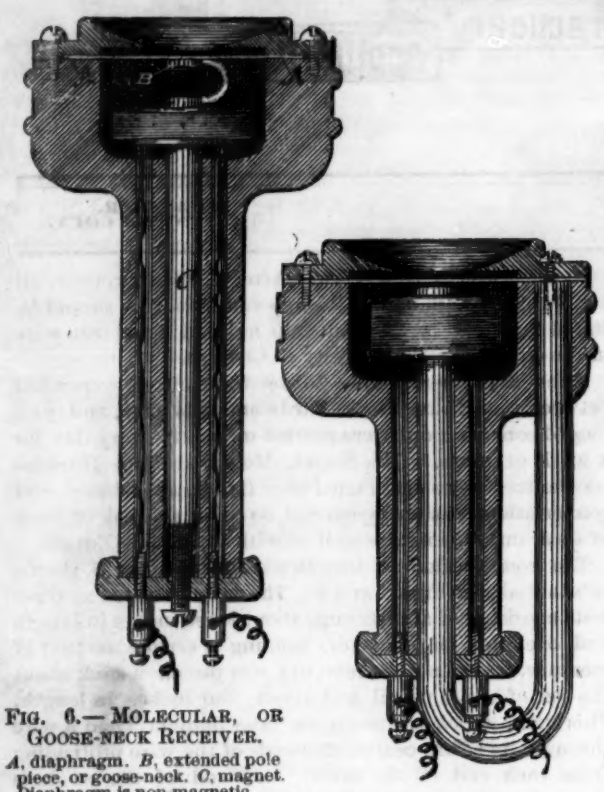


Fig. 6.—Molecular, or Goose-neck Receiver.

A, diaphragm. *B*, extended pole piece, or goose-neck. *C*, magnet. Diaphragm is non-magnetic.

Fig. 4.—Receiver used with Baxter Microphone.

iron, this bar swinging freely on a fulcrum. Normally, the bar lies with its own weight against the diaphragm. Directly in the centre of the bar a carbon button is secured, pressing—through the weight of the iron bar—against the platinum ball secured to the diaphragm. The iron bar resting normally with its own weight against the diaphragm would not be sufficient for an adjustment where loud tones would be used, as the result in that case would be the same as in the Blake or any other microphone transmitter when spoken into with any force, for it would break or rupture the continuity of the circuit irregularly. The adjustment is therefore obtained as follows: A small electro-coil is placed directly opposite the free end of the iron bar, this coil being supplied with a long movable core. The wire of the coil forms a part of the primary circuit of the induction-coil of the transmitter, and the same battery that is used to charge the primary is also used to charge the small coil, so that immediately the battery is

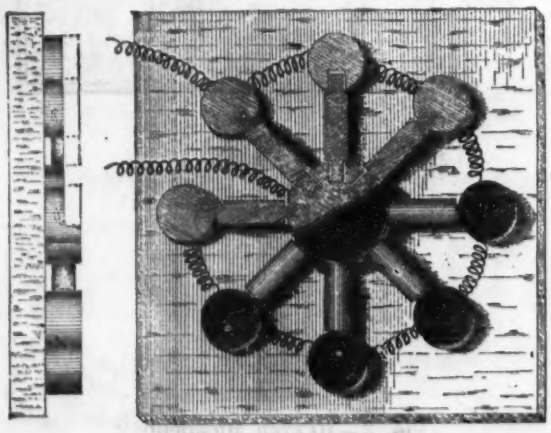


Fig. 5.—Molecular Microphone.

applied the movable core becomes slightly magnetic and creates, according to the position of the core to the suspended bar, a magnetic field, the strength of which is changed according to the advancing or withdrawing of the core to or from the end of the iron bar. The receivers used with the Baxter transmitter were of the pattern shown in Fig. 4, and differed from the ordinary Bell receiver in having a permanent magnet of the horseshoe form instead of a straight bar.

The "molecular telephone," as used at these tests, like those before described, depends upon the Bell receiver. The principal feature consists in the use of a cork diaphragm (Fig. 5), four or five inches square, on one side of which is rigidly secured several small pieces of carbon, arranged about an inch or thereabouts octagonally, we believe, around a common centre piece. These pieces are provided with a small hole at the side opposite the piece in the centre, which is also provided with a similar hole. Fitted loosely in these openings, and extending from the centre piece to the pieces arranged around it are small pieces of carbon rod.

A similar arrangement was described in The Electrical World of Feb. 20, 1883, on page 146, credited to a French electrician, M. Maiche. The claim is made, however, by representatives of the Molecular Company, that there is no vibratory action set up in the diaphragm or the carbon pieces, the claim being that instead of a vibratory action there is a molecular action in the carbon pieces, and also that the cork diaphragm does not vibrate as any other material, but to a certain extent absorbs the vibrations.

With this transmitter a receiver of novel form was used (Fig. 6). It was called the "goose neck" telephone from the fact that the pole of its bar magnet is extended upward against the diaphragm by a goose neck bend or prolongation *B* of its pole. The diaphragm is not magnetic, and may be made of glass, carbon, brass, etc.

Next in order, as used between Cleveland and New York, were not microphone transmitters simply, but the methods, systems and apparatus chiefly invented by Mr. C. A. Randall and now owned by the National Secret Telephone Company. The apparatus consisted of transmitters of special construction, by the use of which induced currents of great force and power are obtained; direct battery current transmitters, in which the power of current may be adjusted in proportion to the distance; hand telephone receivers, constructed on new principles; loud-talking receivers, for which it is claimed that when properly constructed they will operate so as to be heard distinctly several feet away, and which in these tests did actually operate in the Cleveland circuit about one foot from the ear-piece; telephonic relays and repeaters, operating to transfer the message automatically into a second circuit, and working the receiver in a local circuit, as was actually done on the Cleveland and Chicago circuit; methods for overcoming the troubles from induction by the special use of batteries on the main line, by a peculiar adjustment of the main line receiver, and by operating the receiver in a local circuit in the same manner as a Morse sounder is operated.

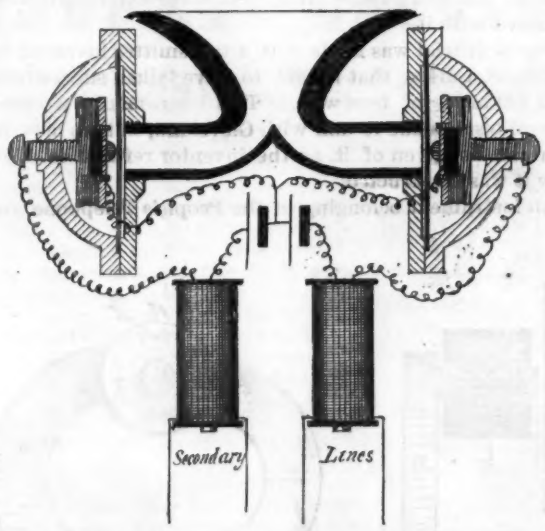


Fig. 7.—Edison Duplex Transmitter and Crown Receiver,

as used by Bell Telephone Co. in tests from Chicago suburbs to New York.

Two carbon transmitters in circuit, with the primaries of two induction coils, having the secondaries in main line.

The Edison duplex transmitter used in the Bell Company's tests is shown in Fig. 7. It is simply the aggregation or consolidation of two ordinary Edison carbon transmitters, so that the vibrations received at one mouthpiece may affect both. Each section has its own secondary coil and is connected separately in its own battery-circuit, though the secondary circuits may be combined together, as may be desired.

Electric Lighting.—XXIV.

FOUCAULT.

In 1849, M. Foucault proposed an improved form of lamp, which, though itself not very practical, doubtless was the starting-point from which the first practical lamps derive their conception. In this lamp the carbons moves horizontally on small carriages, which are urged by springs, tending to move them toward each other, but whose motion has to engage a train of clockwork, with an escapement controlled by the armature of a magnet, whose coils are in the main circuit. When no current is passing, the armature is held back by a spring, and the escapement is released, so that the carriages travel until the carbons come in contact, after which, motion in the clockwork stops. On separating the carbons by hand, after the current was started, the armature moved so as to engage the escapement, and to prevent the motion of the clockwork until the arc had lengthened enough to weaken the current, whereupon the armature fell back and allowed the carriages to move together, till the arc was again of right length, and then the armature again moved to engage the escapement.

M. Foucault also used a current regulator, consisting of two platinum plates immersed in a sulphate of soda solulution, the plates being immersed more or less to diminish or to increase the resistance in circuit as the case might require. The main difficulty with M. Foucault's lamp was its lack of perfection in mechanical details, its cumbrousness and complication. It was not long, however, before his idea of a clockwork mechanism controlled by a magnet was put into practical shape by the assistance of skillful instrument makers, and the lamp assumed a practical shape, which found favor for several years (Fig. 74). It is this form which is generally known as the Foucault lamp, though, as just shown, it is only an improvement on his earlier form.

The peculiarity of this lamp consists in the use of a double set of clock-work, one of which operates so as to bring the carbons together, while the other tends to move them apart. These mechanisms are almost identical with each other, and have similar escapements *o o'*, which are controlled by a little sliding rod with pins that engage against the teeth of the escapement wheels, when in the proper position. The current passes through the electro-magnet *E* on its way to the carbons, and it pulls the lever armature *F*, which is usually held apart from the magnet by a spring *R* acting on a lever *X* pressing on the upper surface of the outer end of the armature *F*. At the point where the armature *F* is pivoted, a rigid arm *T* is secured to it, which tilts laterally one way or the other as the armature moves. It is the motion of this arm that controls the position of the sliding rod engaging the escapement wheels *o o'*.

While no current is passing through the lamp this arm is swayed to the right, and the escapement of the mechanism that moves the carbons together being released, the carbons approach each other. On passing the current the armature *F* moves so as to tilt the arm *T* the other way, and at once this mechanism is stopped and the escapement of the other mechanism is released, so that the carbons now move apart. As soon as the distance has increased sufficiently, the magnet *E* becomes weaker, the spring *R* pulls the armature back, and the arm *T* assumes a vertical position, in which condition both of the escapements are locked; consequently the carbons remain as they are. As the arc lengthens the magnet weakens, until the arm sways enough to cause the release of the feeding mechanism.

The gearing of the mechanism to the carbon-holder was such that the positive one moved twice as fast as that of the negative one, to make up for the different rate of burning of the two carbons, and thus the light always remained at the same focus—an important quality when parabolic reflectors are used. The operation of the lamp was fairly regular and satisfactory, though its complication of parts and consequent liability to get out of order caused inventors to attempt simpler methods of attaining the results.

SERRIN.

M. Serrin produced his first lamp about 1856; but, as in the preceding case, the lamp known later by his name and which eventually superseded Foucault's lamp, was the result of subsequent improvements. It is mainly to the skill and ingenuity of M. Suisse that we owe its perfections in mechanical details. It was in 1859 that M. Suisse made these improvements, and for many years afterward this lamp appears to have been the only one spoken of in France. The lamp, as made by M. Suisse, did not differ very greatly in principle from the earlier Serrin lamp, and for this reason the name never was changed. The later lamp was always referred to as simply the "Suisse make" or the "Suisse type" of the Serrin lamp. In this lamp (Fig. 75) the upper carbon rod *C* is fixed to a vertical rod *B* sliding through a tube that serves to hold it in the proper vertical position, as in the Foucault lamp. The upper carbon clamp *C* is pivoted on a horizontal arm joined to the vertical rod *B* and a screw passing from this rod to a prolongation of the clamp *C* permits a sidewise motion of the clamp which is very useful in adjusting the carbons into line. The lower portion of the rod *B* has a rack which gears into the wheel *F* of a train of clockwork which is thus set in motion by the weight of the rod, provided its escapement wheel *e e* is not locked. On the shaft of the wheel *F* is a smaller wheel or drum *G* to which is fastened a chain *H* passing over the pulley *J* and passing down to be secured to a bracket joined to the lower carbon rod *K*.

The diameter of the wheel *F* is twice as great as that of *G* so that the lower carbon moves up only half as fast as the upper carbon moves down. The armature *A* of the electro-magnet *E* is fastened to a horizontal bar *T U* which connects with a similar bar *R S* above, by means of a vertical bar *S U* the joints being pivotal so that the bar *S U* is free to move up and down with varying attractions of the armature *A*. Normally, this oscillating parallelogram is held upward by a spiral spring *R*. To the vertical portion *S U* of this parallelogram is fastened a triangular "catch" for the escapement, which projects from this bar, passing behind the spiral spring far enough to come

near the escapement wheel or star *e*, which is made like a wheel without its rim. As long as the vertical bar *S U* is held up by the spring, this triangular catch does not lock the escapement, and the consequence is that the carbons are free to move together, but when it descends, as the armature *A* is attracted by the magnet, it then catches the radii of the escapement star and locks the mechanism. Thus, when the lamp is idle and the armature is pulled back, the motion of the wheel *F* caused by the weight of the upper carbon rod is unimpeded, and therefore the chain *H* is wound upon the drum *G* and the lower carbon is also pulled upward until it comes in contact. The way in which the carbons are separated automatically to form the arc is as simple as it is ingenious. The arm which holds the pulley *J* over which the chain passes, is fastened to the vertical bar *S U*; consequently, as the armature is attracted and moves down, on passing the current the pulley *J*, also moves down with the oscillating parallelogram, and as the chain *H* is thus slackened a little, the result is that the lower carbon falls down a slight distance—enough to establish the arc—while at the same time the catch locks the escapement. As the arc lengthens, the forms a derived circuit from the arc and whose action would be to oppose the first magnet, is all that is required to make a perfect series lamp. This was, in fact, done in France by M. Lontin, in 1876, with satisfactory results. This improved Serrin lamp found considerable application for a while, though it has been in great measure replaced to-day in these installations by others which work as well or better and which are simpler in construction.

DUBOSCQ.

M. Duboscq appears to have been an early experimenter with arc lamps. In 1858 he produced, in company with M. Marçais, an ingenious though rather cumbrous and impractical regulating device, in which it was attempted to do away with clockwork. Subsequently M. Duboscq returned to clockwork devices, and his labors culminated in the lamp since well known by his name all over Europe, and which has had a successful career (Fig. 76). If this lamp did not surpass the Serrin lamp in excellence of working, it was nevertheless considerably simpler and less liable to get out of order. Two wheels *G* on one shaft are impelled by a coiled spring so as to cause the upper carbon rod *D* to move down, the lower rod *O* to move up. The the working of the lamp was controlled by the armature lever *S T*, in a manner already understood from the preceding lamps.

This simple escapement recommends itself to inventors as a good practical one. Usually it is necessary to multiply the wheels in order to get the retardation or slowness desired, but the use of the worm in such a case is an excellent means of attaining the same object. Out of this mechanism, with a little ingenuity, and with the addition of the derived circuit, a good, compact, practical lamp might be constructed.

GAIFFE.

Among the lamps which attracted attention just previous to the beginning of the present electric lighting era, may be mentioned that of M. Gaiffe, a celebrated maker of philosophical apparatus in Paris. In this lamp (Fig. 78) the lower carbon rod itself forms the armature by its lower portion, which enters a solenoid *L*, wound with coils, increasing in thickness toward the lower portion. On the spindle *W* is carried a box *O*, for a coiled

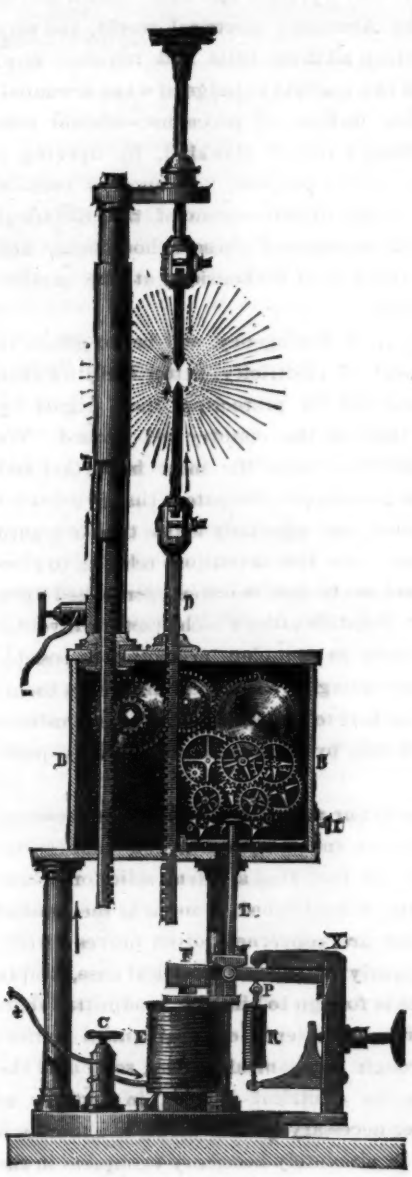


FIG. 74.

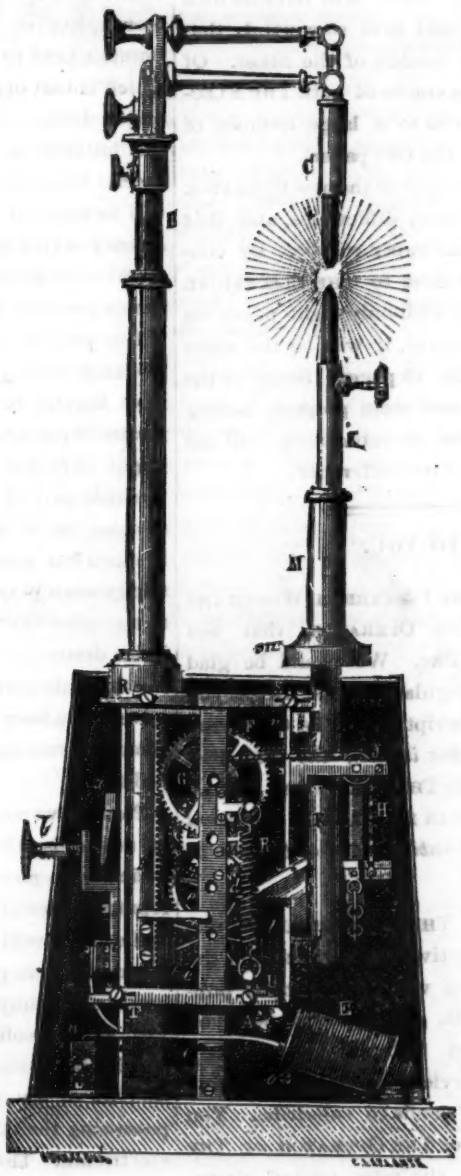


FIG. 75.

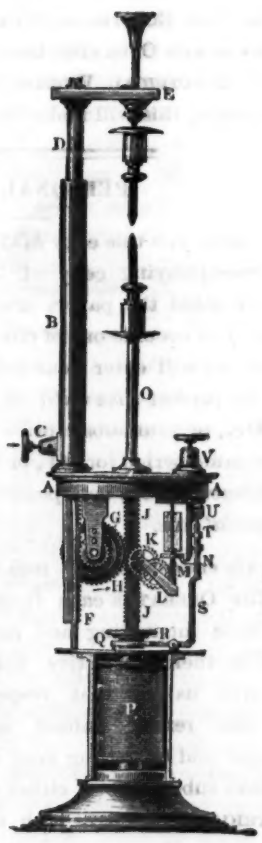


FIG. 76.

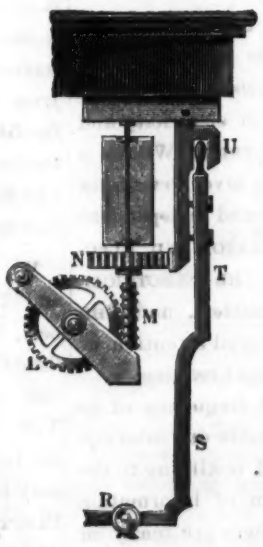


FIG. 77.

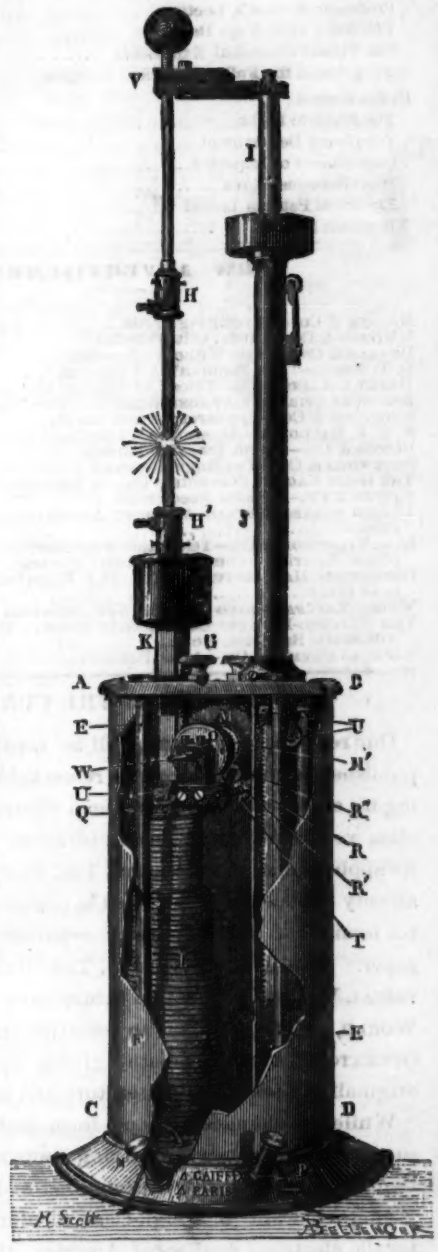


FIG. 78.

magnet will necessarily weaken, and the armature will move upward sufficiently to cause the escapement wheel to be released a little, when immediately, the current growing stronger by the approach of the carbons, the armature is attracted again and the escapement is locked.

As already stated, this lamp held its own for a score of years, and it is used even now in the lecture room and for projections. For these purposes no better lamp exists, because it has the great advantage that the light always remains at the same focus in the reflector, instead of moving downward, as is the case in the most of later lamps where the lower carbon does not feed upward. As a lamp for single light circuits, none has ever given better satisfaction, and it was as perfect in 1859 as it is to-day. Of course to attempt working two such lamps in series in one circuit would be useless, simply because they would each have to depend on the weakening of the currrent in the whole circuit for their regulation, and as one fed, the approach of its carbon would increase the current in the whole circuit so that the other would immediately cause its carbon to separate *further still*, and the result would be an alternation of ups and downs, as each in turn "robbed" the other. Still, in this lamp, the simple addition of a "differential" magnet, that is to say, one whose coils rack *J* of the lower carbon holder is double and gears with a toothed wheel *K*. Normally, the carbons move into contact as rapidly as the mechanism allows, this motion of the wheels being retarded by a fan. There is no mechanism for separating the carbons, but as the lamp, in the lecture room and in illuminations, was in those days always constantly under the care of an attendant, this was not a serious objection. The upper carbon clamp was fastened to an arm which could be slipped back upward at *E*, so as to form the arc. The feeding mechanism was exceedingly simple, and is shown in Fig. 77. The wheel *L* was set in motion by the wheel *K* (shown in Fig. 76) and geared into a worm *M* on a vertical shaft carrying the escapement wheel *N*, and above this was an ordinary clock fan.

The armature *Q* of the electro-magnet *P* (Fig. 76) was pivoted at *R*, and a vertical arm *T S* arose from it, the upper end of which fitted into a notch *U* (Fig. 77) of a lever of the form shown, which was pivoted to the frame of the lamp at its upper end, and carried a blade at its lower end, so as to engage the escapement wheel *N*. This happened on starting the lamp, for the attraction of the armature *Q* caused the arm *S T* to tilt and push this blade into the teeth of this wheel. When once started, spring, and also two toothed wheels, one of which M^1 is geared into the lower carbon holder *K*, while the other *M* gears into the upper holder *I*, these two wheels being insulated from each other. The difference in diameter is, of course, intended to make the carbons feed at different rates, just as in all the preceding lamps. The spring tends to move the carbons together, as in the Duboscq lamp. When the current passes, the lower rod *K* is pulled down into the solenoid *L*, in opposition to the coiled spring, and thus the arc is started. With the consumption of the carbons the solenoid weakens and allows the rod *K* to move upward under the influence of the spring, which at the same time causes the upper carbon *H* to move down. There are also a few minor devices in this lamp, such as pinions *RR*,' which may be made to gear into the wheels *MM*' for the purpose of moving either carbon rod, and also a key *G* to release the racks from the wheels. The object of winding the solenoid in this form is to give it a longer range of attraction. In a solenoid of the ordinary even form, the attraction diminishes markedly after the armature has entered into it a certain distance; and by making the number of turns greater at the lower portion, the centre of attraction is carried below the usual point.

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GREENWICH MANUFACTURING Co.—The Waterbury Watch; Rolled Gold Rings 268
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"SUB-DIVIDING THE CURRENT."

Our readers, we are sure, will be glad to learn that the publisher, encouraged by the remarkable success attending his efforts to supply American electricians with a first-class weekly review of current progress in electricity and its applications, considers that THE ELECTRICAL WORLD is already sufficiently established in popular favor to warrant his issuing it hereafter as a separate and independent paper. Instead of one journal, THE OPERATOR AND ELECTRICAL WORLD, we shall in future have THE ELECTRICAL WORLD, weekly, devoted to scientific matters, and THE OPERATOR, twice a month, giving special attention as originally to telegraphic literature and light reading.

While the changes in scope, form and frequency of issue have led to a most gratifying increase in our subscription list, exceeding our expectations and testifying to the 'long-felt want" of a high-class medium of information for the electrical workers of America, there are many of our old-time telegraphic friends—those who were the stronghold of THE OPERATOR in the days of its struggling infancy—who miss the old paper, with its fund of entertainment, of airy professional gossip, and of fraternal good-fellowship. On the other hand, especially among more recent subscribers, there is an equally numerous class which is interested in electrical work only in its scientific aspects, and to which the chronicles of the doings of the craft, except as they relate to scientific progress, are a waste of space that might be filled with (to it) more valuable matter. A happy solution of this conflict of interests offers itself, and we present it to-day.

It was the boast of a distinguished journalist, now dead, that he was the editor of "two newspapers, both daily." It is our present ambition to edit two journals, both electrical, and to make each the best in its own field.

In the ELECTRICAL WORLD we shall present the latest discoveries, inventions, discussions and theories connected with electricity, and shall strive to make it indispensable to every worker in the electrical field who does not want to lag behind in the struggle for existence.

In THE OPERATOR it will be our aim to provide a medium for recreation from the toil of the office and the exchange; where the existence of such troublesome things as induction, resistance, electromotive force, algebraic formulæ and geometrical symbols may, for the time, be ignored; where the daily life and personal gossip of the fraternity may be set forth, the latest amusing incidents of the profession enjoyed, confidences exchanged, old times recalled, and grievances discussed and righted, undisturbed by the rumble of the dynamo or the glare of the electric light.

By excluding from each journal what appropriately belongs to the other, we shall be able to present in each a far greater quantity of matter of interest to its readers than has heretofore been possible. In order to maintain the high standard we have set for THE ELECTRICAL WORLD and THE OPERATOR, the editorial staff has been strengthened, and no pains or expense will be spared to that end. THE OPERATOR will be the largest, handsomest and cheapest telegraphic paper ever published, and THE ELECTRICAL WORLD will, as heretofore, leave nothing undone to maintain its supremacy as an American electrical journal.

The two papers will be entirely distinct and independent of each other. It is not intended that anything published in one will be used in the other. Each will have its own field and will endeavor to fill that field so worthily that readers of the one will also be readers of the other. Of the present issue we are mailing copies of both THE ELECTRICAL WORLD and THE OPERATOR to a large number of non-subscribers, to let them see the two papers.

It is proper to say that the first issue of the new OPERATOR has been got out in the face of many difficulties, and that it is not a fair sample of what the paper will be. By confining the advertisements this issue to THE ELECTRICAL WORLD we are able to get along with only eight pages on THE OPERATOR. In future, however, it will be the same size as THE ELECTRICAL WORLD, 16 pages. Some of the articles in THE OPERATOR this issue more properly belong to THE ELECTRICAL WORLD, but as subscribers will see both papers, this will make but little difference.

PERSONAL TO YOU.

We send you this copy of THE ELECTRICAL WORLD and the accompanying copy of THE OPERATOR, that you may see what the papers are like. We would be glad to have you become one of our regular readers. To get you started, we will enter your subscription to the OPERATOR *from the present time until the last issue of the year* 1883 *for* **50c.**, or your subscription to THE ELECTRICAL WORLD for the same period for **$1**, or both for **$1.50**. *We would like to have you try both papers until the end of the year at this special rate.*

We are endeavoring to make THE ELECTRICAL WORLD and THE OPERATOR each distinctively American, and the best, most interesting and most valuable journals published in their respective fields. Any assistance you can give us in that respect will be appreciated. You can render valiant service by recommending the paper and by getting your friends to subscribe. You may take subscriptions either for THE OPERATOR or THE ELECTRICAL WORLD, or both, at the rates quoted above, which you will see are exceedingly low for such papers as both will now be. We will be glad to substantially appreciate your kindness in getting subscribers for us, and would be pleased to hear from you and to know what you think you can do toward increasing the circulation of THE OPERATOR or of THE ELECTRICAL WORLD. Extra copies of either paper, circulars, etc., mailed free on application.

OUR ELECTRICAL AGENCY.

Success in science or art, as well as in business enterprise, is in a great measure due to the excellence and convenience of the conditions under which the efforts to attain it are made. As the development proceeds in each case, so must the facilities on which it depends be enlarged. Indeed, the best evidence that could be desired of the growth of science and its extension into the industries is the increasing demand for these accessory facilities. Especially is this so in the case of electricity. Ours, in truth, is the science of the age, and the one which has held forth, in this era of unparalleled progress, more bright and attractive promises, and which has fulfilled more of them, than any other; and yet all are agreed that we have only seen the beginning of its development. As Edison once put it: "So far, we have only been peeping at the Elysian fields of electricity through little chinks in the deep inclosure which encompasses all its beautiful capabilities." Electricity is a deep mine of treasures. We have arrived as far as the gold seeker who has made a valuable "find;" we have delved in the vein just long enough to come in sight of the treasures which it holds. We are satisfied that the ore is rich and that it is abundant. It is precisely at this time, then, that the convenience, even the necessity, of a whole special system of accessory implements and facilities becomes apparent.

To those who work in this rich field, there should be ready facilities for securing protection, encouragement and assistance, and there should be a medium through which necessary information and advice may be obtained in cases where it is wanted and is not at hand. Our intercourse with electrical men in all parts of the country, and the knowledge of their needs, which we have acquired at various times, but especially within the last two years, have gradually forced upon us the conviction that this void should be filled as soon as possible. The suggestion has been urged upon us that a journal like ours—which is the mouthpiece of the American electrical world, the very fountainhead to which all these calls and requests flow, which is best of all in a position to judge of what is wanted, and to decide on the method of procedure—should take the initiative in filling a void of this kind, by opening a special department for the purpose. In another column will be found the formal announcement of the Electrical Agency which is the outcome of these exhortations, and of our own desire to fill what we consider at the present time a pressing want.

The primal object of the agency will be to afford to inventors in the field of electricity, better facilities than have heretofore existed for protecting their rights by means of patents, both in this country and abroad. We might say that in these days the most important and intrinsic part of an invention is the patent that is intended to cover the invention, and especially is this true in regard to electrical patents. As the inventions relating to electricity multiply, and as the field becomes encroached upon to a greater extent, the difficulties which beset the inventor in his desire to obtain as complete protection as possible also increase correspondingly. Electrical inventors themselves have been the first to recognize that their business should be managed only by those who are specially qualified for it.

There have come to our notice, of late years, expressions of much dissatisfaction and complaint in this connection, which go to prove the fact that a patent solicitor, whose reputation for ability is established, in so far as mechanical and other inventions are concerned, often proves utterly incompetent to properly manage an electrical case, simply because the subject is foreign to him. It is admitted that, just as the solicitor of patents on mechanical devices should be a thorough mechanical expert, so should the solicitor of patents on electrical devices, in addition to possessing the other necessary qualifications, be a thorough electrician. This is absolutely necessary to success in the work. Even the simple matter of a model, or of a drawing, an accessory of much less importance than the specification and its claims, should be attended to by persons of experience in electrical work.

In opening this department we have taken pains to make its appointments so complete as to insure to its patrons the successful and satisfactory service which they should have. As a guarantee of its efficiency in the performance of its duties, we need only add that the Electrical Agency has been placed under the special direction of Mr. C. O. Mailloux, a prominent electrician and scientific expert, already well known to our readers in connection with the articles on "Electric Lighting" and other subjects from his pen that have appeared in these columns, and which have elicited so many favorable comments.

Mr. Mailloux will give personal attention to all electrical details, and will be assisted by a corps of competent men of experience in patent matters. Prof. N. S. Keith, of this city, a celebrated electrician and scientist, as well as a noted expert in electrical patents, has also been retained as one of the consulting experts of the Agency. Others of like ability will be added to the force as occasion demands, so that our patrons may feel confident that their cases will fall into most competent hands.

Besides the patent department, this Agency will com-

prise a technical department, for furnishing general electrical information and doing expert electrical work of all kinds. Frequent cases arise where it is convenient to call in the services of an expert to decide on various electrical matters, and we have often received inquiries from capitalists asking us for advice or asking us to refer them to some competent electrical expert. Moreover, there are many cases where those interested in a particular line of investigation or experiment would gladly pay a reasonable amount for securing information in regard to certain points, if they only knew *where* to procure the information. In addition, there are also many cases where the advice of an expert electrician becomes a matter of periodic necessity, yet it would not be judicious to retain an electrician constantly in the employ of the concern, on account of the expense. We have known several cases of this kind where the facilities of our Agency would have proved a boon. This department offers facilities which cannot be obtained anywhere else, and by combining it with the patent department, the force of men may be advantageously distributed over both, so that the expense will be materially reduced. The extensive experience of Mr. Mailloux in electrical work of all kinds will be a sufficient guarantee of the efficiency of this department.

THE UNDERGROUND PROBLEM.

The action taken at the meeting of the "Committee on Underground Communication," of which we give a full report in another column, deserves the careful attention both of electricians and of others interested in this important subject. The resolutions adopted will be welcomed on all sides as being timely and practical. They give a sense of relief from a good deal of the misconception and misapprehension which has for some time filled the popular mind in regard to the matter of running wires underground. They will recommend themselves to legislative bodies and other authorities which control franchises, and it is here especially that they will prove beneficial, by presenting the question clearly and intelligently. It is to be hoped that we may now experience a period of abatement in the feverish opposition to overhead wires which has of late raged in certain parts of the country. The resolutions show that the companies are awake to a sense of the situation, and in them they indicate their willingness to give the matter the full measure of consideration which it requires, without waiting for the authorities to decree hasty and arbitrary measures that can only react unfavorably on the community at large.

If there is any matter wherein legislation, especially hasty legislation, is to be deprecated, it is in one like this, which involves problems of intricate science and in which the question of possibility, forsooth, is the first in order. In the face of the sentiment which has been growing in the public mind, and which tends to urge them to vacate their "rickety structures," these companies have been in a somewhat unpleasant predicament. They are very much in the position of a man whose lease has expired—who does not care to renew it, and, in fact, who *cannot* renew it, but yet has no other place to move into where he may expect to be more comfortable or even as much so.

The electrical companies would be delighted to run their wires underground, and these resolutions show their good disposition in the matter. But there are serious difficulties to be overcome before the solution of the problem becomes a possibility. An ideal system like that which the case requires is a difficult one to obtain. The reason is not that the mechanical difficulties to be overcome in underground systems are serious of themselves; on the contrary, they may even be considered as being already solved, at least to a very considerable extent. The laying of conductors in underground networks has been accomplished in Europe, with a fair measure of success, particularly in Germany, where it has become a matter of every day practice. In Paris we have a still nearer approach to an ideal system, for we find telephonic and telegraphic conductors carried in "*réseaux*" together in the great sewers for which that city is famous.

It is in the electrical difficulties that the greatest trouble will have to be encountered. In a combined system, designed to accommodate every industry by electrical agency, we must anticipate the association of currents differing most widely in character. We have to transmit currents of all orders, from that of the highest electromotive force to that of the lowest; from the most intense to the most subtile; from the most uniform to the most uneven; all, so to speak, heterogeneous units that can clash against each other in a combined system by means of a common weapon—induction. How shall we *assimilate*, or else, as the case may be, *dissociate* these currents to prevent them from interfering with each other? That is the all-important element of the problem. In a multiple system of this kind every impulse of current, every variation of potential in one wire is felt, by induction, in all the other wires composing the network; and of all the expedients resorted to for preventing these effects, none appear to be entirely successful. It is to the telephone especially that this fact proves a serious and a disagreeable one. In an article on the subject of telephonic induction, by M. du Moncel, which was translated from "*La Lumière Electrique*" for the ELECTRICAL WORLD, and published in our issue of March 10, the subject was placed in a clear light. It was shown that just exactly as we diminish or eliminate the inductive effects, by means of balancing forces acting in opposition, so far do we bring into play another phenomenon none the less undesirable—retardation.

The fact is, a great deal of study will be required to solve the problem fully. The ideal system, when it is introduced, should be as perfect as possible, so that it can count upon a long lease of life; and as it will take time to arrive at this degree of perfection, we only do our duty in enjoining the public to be patient at the present time more than ever. The subject is now formally introduced for discussion, and as Professor Morton pertinently remarked at the meeting, "these resolutions are about all that could be done, and all that need be done to get the matter under way." The rest will follow as a matter of course, and in the proper time.

The absence of the Mayor of the city and of the Governor of the State from the meeting may appear to be a matter of insignificance, but in our opinion it is to be regretted. It appears to us that in this and like matters the public authorities should take the initiative, rather than let it be taken by private individuals, for in the latter case there is always a suspicion and a fear of attempts at monopoly. A system of such evident utility to a whole community should not confine its advantages in favor of a few individual corporations, but should, on the contrary, give equal rights and privileges to all, under suitable regulations. For our part, we would recommend to the City Fathers the adoption of the Paris system. Let the city take upon itself the matter of providing these conveniences, and let it open them to all who may wish, at a proper rental. We believe it would be even a paying investment in the end, while in this way there would be much less danger of monopoly. It is not right for twenty-one or any number of corporations to presume to consult their own convenience, and that to the exclusion of the rest; it is too much like an array of the strong against the weak, intended purposely to harass the latter. The circular which announced the meeting said there were five electric lighting companies in this city; these are presumably those interested in the "Gramme combination." As a matter of fact, however, there are a dozen or more electric light companies in the city. Some of these "forsaken" ones are doing a lucrative business, too, and the fact that they are not so old as their compeers does not appear to us a valid reason why they should be shut out of heaven, by being ignored in this orthodox manner. There may be doubts as to some of them, but we feel certain that others have as good a right to existence, and were entitled to as much recognition as any, in a matter that concerned them as well as the rest.

Electrical Culture.

There seems to be a disposition on the part of many persons engaged in electrical pursuits to argue that a purely "practical" telegrapher, or telephone or electric light man, is all that is necessary to insure success, and that *theory* may as well be disregarded as far as everyday work is concerned; or, at least, confined exclusively to the laboratories of very studious and painstaking experimentalists.

We hear from many quarters that the "scientific" worker is not fittingly appreciated, and that, as promotion goes now, there is no use in spending one's time in theoretical study.

As a matter of fact, we believe that there could be no more pernicious doctrine advanced, and that this sort of narrow-mindedness is doing much more than anything else to keep down the standard of electrical works.

It is essential to the success of the business of the electrical world, not less than to the welfare of its workers, that each individual should be versed in the theory as well as in the practice of his profession, and know the cause and the why and the wherefore, as well as the effect which is palpable to all.

It has been, and is now, the object of THE ELECTRICAL WORLD to lead every one of its readers, by easy stages, to appreciate the value of scientific training, and to record faithfully the various changes and improvements in electrical work.

The electrical field in front of us is a wide one, and we believe that it will continue to widen for the next quarter of a century, and that as time shall go on, it will demonstrate that the most successful workers will be those who have read and studied the theory as well as the practice of electricity.

A Valuable Table.

By the courtesy of Messrs. Walter T. Glover & Co. electrical engineers, Manchester, England, we are enabled to present to our readers with this issue, as a supplement, a table of the relative dimensions, lengths, resistances and weights of pure copper wire. The Messrs. Walter T. Glover & Co. are so well known as makers of electrical wire and cables that the value and utility of this table, calculated and compiled by them, will be appreciated by those interested in electrical measurements of all kinds. Great pains have been taken to make the computations correct and accurate, as is to be noticed in the extension of the decimals. As such a table is sure to prove useful and convenient in the office as well as the factory or laboratory, we have put it in form suitable to be framed. The figures are printed in large clear type, and suitably spaced to avoid confusion and to make the reference more easy The addition of the constants of the Brown & Sharpe Gauge will render the table applicable to wires of this gauge. Should any additional copies of the Supplement be desired, they will be mailed free on application.

Telephone Rates.

The expectation of a general increase in telephone rentals, which was entertained by some persons after the victory of the American Bell Telephone Company in the courts several months ago, and the subsequent reports of consolidation movements, appears to have been groundless. We would be sorry to learn of the inauguration of such an increase, which could hardly fail to check the rapid and healthy growth of the telephone business. The telephone, while to many a business necessity, is to many others simply a luxury, which they could easily dispense with, should it become too costly. We have no doubt there are thousands of persons who would use the telephone, who are debarred, even by the present rates, from its employment, and we believe it would be the part of wisdom to reduce rather than increase the rentals charged. It is true the telephone makers say they are even now unable to supply the demand for the instruments, but this hardly seems a plausible reason for limiting their use, in a country so full of ingenious and skillful mechanics as ours.

Accidents from Electric Lighting Wires.

There has been a noticeable absence, for some months past, of reports of casualties or fatalities caused by persons coming into contact with electrical conductors charged with powerful currents, such as were painfully frequent for a while last year. As the number of such conductors has been constantly increasing, it is evident that in this instance the old saw has been reversed, and instead of familiarity breeding contempt, it has engendered a salutary respect for some of the properties of what Mr. Edison is pleased to call "the deadly high-pressure current," or that electrical engineers have learned better how to protect ignorant or foolhardy persons against the consequences of their ignorance or rashness. Probably both causes have contributed toward the pleasing result. As we pointed out at the time, to guard against such accidents is no complex problem in electrical engineering. We hope it may be long before we have to record another casualty.

Legislation and Underground Wires.

Three hundred and fifty patented devices in this country for conveying electrical currents underground, not one of which will work—such is, in effect, the report of the committee on underground wires, representing the principal companies interested in electrical transmission in New York City—a mournful story of misguided inventive effort. So the problem of underground conductors remains about as it has been, with no indication of a speedy solution, and those municipal and legislative bodies which have been so hasty in passing ordinances and acts to compel the burying of electric conductors are placed in the ridiculous position of legislating against a physical law; for electrical induction is apparently as little affected by the fiat of a city council or a State legislature as the comet in the Middle Ages was by the pope's bull.

THE interesting account of recent experiments in long-distance telephony in another column will serve to excite discussion, if nothing else. While we believe that at present a long range telephone, if practicable, would not be profitable, the subject is decidedly an interesting one, and its discussion should lead to good results.

Meeting of the Underground Committee.

The representatives from the twenty-one electrical companies invited to be present at this meeting, met at the office of the Gramme Electrical Company, Room 47, No. 115 Broadway, on Friday last, as announced in our last issue. The following companies were those that had been invited:

The Western Union, Mutual Union, B. & O., Rapid, Postal, Bankers and Merchants', Gold & Stock, Mutual District, Manhattan District, Law and Time Telegraph companies; the Metropolitan T. & T. and Metropolitan District T. & T. Companies; the Brush, Edison, Weston, American, Fuller, United States and Jablochkoff Electric Light companies, Holmes Burglar Alarm Company, Western Electric Company.

Invitations had also been sent to Professors of the Sheffield Scientific School of Yale; Prof. Cross, of the School of Technology, Boston; Prof. Morton, of the Stevens Institute of Technology, Hoboken; Profs. Brackett, Cornwell, and Magie, of Princeton; President Barnard, of Columbia College; Professors of the School of Mines, Columbia College; Prof. Barker, of the University of Pennsylvania; representatives of the scientific departments of the College of the City of New York, and the University of New York, Gov. Cleveland and Mayor Edson.

Among the gentlemen present at the meeting were Messrs. C. R. Flint, H. Cummins, Colonel R. R. Hazard, S. W. Hebard, H. W. Pope, Major Eaton, Prof. Henry Morton, Prof. N. S. Keith, E. Holmes, W. E. Athearn, W. C. Behrens, R. W. Blackwell, A. B. Chandler, J. P. Davis, H. C. Roome, Henry Morton, Frank Shaw, T. J. Montgomery, C. A. Cheever, H. L. Bailey, S. J. Gordon, S. L. Parrish, C. W. Price and S. P. Frick.

The meeting was called to order by Col. Hazard, who briefly stated its objects and purposes substantially as they had been announced in the circular calling the meeting. The meeting then proceeded to the selection of regular officers, and Mr. J. P. Davis, vice-president of the Metropolitan Telephone and Telegraph Company, was elected chairman, and Mr. W. C. Behrens, of the Gramme Electrical Company, secretary.

A few preliminary remarks were made by the chairman, and the regular business was declared open for discussion. After an interval of silence, Col. R. R. Hazard made some brief and pertinent observations in regard to the underground question and its present aspects, and then read a series of resolutions prepared by him for the occasion. He stated that, in his opinion, the general committee which was to be the result of this meeting would do well to divide itself into special sections or sub-committees. He submitted that in treating the subject there were three sets of questions to be considered distinctly and separately. The first were the electric and mechanical questions; that is to say, all those which relate to the system and its working details. The second were the legal questions, or the matters of rights, franchises, etc., which might arise. The third was the financial question. He argued that each of these points called for mental qualifications and abilities of an entirely different order from the others, and could be better disposed of by a committee especially prepared and adapted for the task.

Some discussion followed in regard to certain clauses of the resolutions, and the result was a few amendments, mostly of minor importance, with the exception of those relating to the powers of the general committee, which were construed anew so as to be more restrictive. The resolutions were then unanimously accepted. The following is the text of these resolutions as accepted:

Resolved, That, in the opinion of this meeting, the time has arrived when it is expedient to make an exhaustive examination of all devices and inventions pertaining to the subject of underground electrical communication, with a view to determine whether any inclusive system can be found which will enable the electrical corporations to establish such communications.

Resolved, That it is the sense of this meeting that the public desire to relieve the thoroughfares from poles and wires is quite in accord with the wishes of the corporations, and that the true interest of the shareholder is to be found in a permanent, inclusive and protected system.

Resolved, That the problem presented to the corporations and the electrical engineers is complex and difficult, and in the opinion of this meeting has not yet been fully solved; that any system to be adopted must combine the highest efficiency with reasonable economy, and serve inclusive interests; that while it is perhaps possible for trunk-line telegraphs to avail themselves of existing devices, it is not possible, in the present state of the art, for services connecting every house in the city so to do, without an expenditure so vast as to be prohibitory in most instances, and that therefore hasty compulsory legislation is to be deprecated as being destructive to useful and indispensable public conveniences.

Resolved, That a committee be appointed by the chairman of this meeting, either now or hereafter at his option, consisting of one delegate from each electrical corporation invited to be present at this meeting, the Governor of the State and Mayor of the City of New York, with power to add to its number; which committee shall be authorized to examine the subject in respect to its scientific, mechanical, legal and financial considerations, with power to adopt such course of procedure as may appear advisable to it, after such examination; and, with the approval of the respective corporations, form a company in the collective interest, and consider such inventions and devices in that behalf as may prove to be indispensable to a successful installation.

Resolved, That a copy of these resolutions be sent to the Governor of the State, the Mayor of the City of New York and to each corporation invited to be present at this meeting.

The committee appointed in accordance with these resolutions consists of Governor Cleveland, Mayor Edson and the following representatives from each company:

H. L. Bailey, Time Telegraph Company; D. H. Bates, Western Union; A. B. Chandler, Fuller Electrical; W. A. Childs, Law Telegraph Company; H. Cummins, Postal Telegraph Company; L. E. Curtis, United States Electric Light Company; J. P. Davis, Metropolitan T. and T. Company; S. B. Eaton, Edison Electric Light Company; C. R. Flint, Weston Electric Light Company; R. R. Hazard, Gramme Electrical Company; E. Holmes, Holmes' Burglar Alarm Telegraph Company; C. B. Hotchkiss, Mutual District Messenger Company; W. M. Ivins, Jablochkoff Electric Lighting Company; F. R. May, American Rapid Telegraph Company; T. J. Montgomery, Brush Electric Company; G. S. Mott, Bankers & Merchants' Telegraph Company; H. W. Pope, Manhattan District Telegraph Company; C. W. Price, Baltimore & Ohio Telegraph Company; A. C. Richards, Automatic Signal Telegraph Company; J. Eliot Smith, Fire Department Telegraph; Elihu Thomson, American Electric Company. Representatives of the Gold & Stock Telegraph Company, Mutual Union Telegraph Company, and the American District Telegraph Company have yet to be appointed.

The committee met at the office of the Gramme Company on Thursday, April 25, and organized permanently as follows: J. P. Davis, chairman; R. W. Blackwell, treasurer, and H. C. Behrens, secretary. Messrs J. P. Davis, R. R. Hazard and Fredrick H. May were appointed to present nominations at the next meeting for the permanent sub-committees.

Remarks were made by several of those present. Mr. Robert B. Minturn said he was confident that the underground wire bill now pending in the legislature would not pass. Mr. Minturn characterized it as an unjust and tyrannical bill, and one that should not be permitted to pass. There was among the companies enough good disposition to satisfy the public, but the remedy was not at hand, and they were compelled to wait for a system that would be applicable to their needs. Mr. W. M. Ivins said that there were great difficulties to be overcome, and prompt, harmonious action was necessary to bring to light some practical solution of the problem. Remarks were also made by the chairman, Col. Hazard, and by Messrs. A. B. Chandler, T. J. Montgomery and others before the meeting adjourned.

A New Electric Motor.

The subject of electric motors is one which received much earlier attention than that of dynamo-electric machines. In fact, the very first application of Oerstedt's discovery of electro-magnetism that was thought of was the construction of motors. For many years a vast amount of study was directed to the subject, and the electric boat of Jacobi, in Russia, as well as the electric locomotive of Page, in the United States, are records of the wild expectations which were then entertained of this means of producing motion. The advent of the dynamo-electric machine appears, however, to have turned the minds of scientists and inventors in another direction, and in consequence another period elapsed during which the electric motor was neglected. It is especially of late years that, in the absorbing interest caused by the electric light, the electric motor has received the least attention, and yet this is precisely the time when it would be of greatest interest. The little motor which was invented by M. Marcel Deprez, a year or two ago, and that which was subsequently produced by M. Trouvé and which worked the electric boat at the Paris Exposition, have passed into such extended domestic use in that short time as to afford an excellent proof of this. Within the same time a similar motor has been improved by Mr. Griscom in this country, and it has of late come into very extensive application, not only here, but in England as well. There are a thousand and one places where a little motor is needed, and where such a motor is just the thing desired. Its principal excellence is to be found in the neat and compact design given to it—a feature which will recommend it to many uses where a cumbersome and unsightly contrivance would be rejected, especially in domestic uses.

The motor is of the same type as the Deprez and Trouvé motors, inasmuch as its armature is of the old Siemens form; but the magnetic field in which the armature revolves is entirely different in shape. It is made in the form of an iron cylinder and wound with wire after the manner of a Gramme ring, in two large sections, which have a space between them. The wires are connected in opposition, or in such a manner that each uncovered portion of the iron forms a "consequent point" or pole of the magnetic field. The commutator is compactly disposed out of sight, and the connections are neatly arranged to an end-plate, which also has the fixture for fastening the motor to a sewing machine frame or other mechanism it is intended to operate. The motor has received the name of "double induction motor," from a peculiar phenomenon which was noticed by its inventor while experimenting with it. Ordinarily, the armature is included in the same circuit as the coils on the field magnets. Mr. Griscom once happened to pass a current through the armature circuit alone, the field circuit being disconnected. In this condition the armature, being powerfully magnetized, acted on the iron of the field magnets and tended to move so as to bring its poles in a line with the poles of the field magnet, and there, the magnetism of the armature being reversed, a mutually repulsive effect between this pole and the residual magnetism of the field magnets arose and tended to cause the armature to move away toward the other poles, so that once started the armature would continue to turn somewhat slowly. It was found, however, that if the field circuit, while still detached from the battery circuit, was simply short circuited upon itself, the motor would begin to revolve very rapidly. Mr. Griscom concluded that by the motion of the armature its lines of force are cut by the field magnet coils, and thus give rise to a current in the latter which helps to magnetize the field, and he ascribed the phenomenon to the peculiar conformation of the field magnet, which is such as to bring its wire close to the revolving armature. Those who remember the Gramme alternating current machine, will notice the close resemblance in principle, the essential difference being that the Griscom motor has only two consequent poles instead of six. This new phenomenon has attracted much attention and caused considerable discussion, especially in Europe. For our part we do not accept Mr. Griscom's theory, for we have seen such an armature produce the same effects when rotated in an ordinary old Siemens field, and in experiments which we have made on the subject it has not been found that the shape of the field had any influence on the results. The theory which seems to be the most compatible is that the closed circuit simply prevents the induced magnetism from diminishing on account of the "Lenz effects" which arise in the closed circuit, and that as the magnetism is slightly increased at at each turn by the induction of the armature, the magnetic intensity of the field soon reaches a maximum. Whatever induction is produced by the lines of force of the armature must necessarily be of a nature to oppose the motion instead of helping it. This inference is indeed a valid consequence of Lenz's law.

FIG. 2.

FIG. 1.

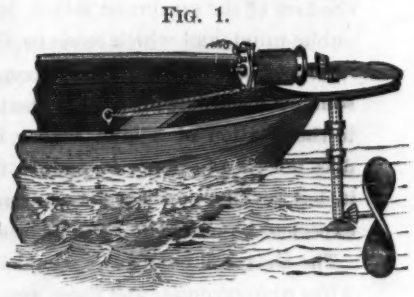

FIG. 3.

When the field magnet is in the same circuit as the armature, and fed from a battery current, the phenomenon does not occur after the magnets have reached saturation, which takes place almost instantly; so that the term "double induction" is a misnomer. However, the motor can sustain its reputation quite well, even without the supposition of double induction, for it certainly attains a remarkable efficiency. It is said that it can lift 2,000 times its weight (40 ounces) in one minute, when working with the full battery power. This gives it a capacity of nearly one-sixth of a horse-power. Its efficiency has not, to our knowledge, been calculated, but we should expect it to be very high, at least 80 per cent., for the high speed

of the motor is very favorable to economy, and there must be but little internal loss from useless heat and friction. In connection with this motor, its makers, the Electro-Dynamic Company, of Philadelphia, have produced a battery of great convenience. It is well known that with a given constant battery power the speed of an electromotor depends on the work which it has to do. Suppose we apply the motor to a lathe (Fig. 1), for instance. With a constant battery, the moment the tool is taken off from the work, the motor will increase in speed greatly, which is undesirable. This inconvenience is obviated by the arrangement for regulating the strength of the bichromate battery. The battery is made of six elements placed in a box, all the plates being fastened to a mechanism for raising them out of the solution. This mechanism is operated by a treadle. By pressing on the treadle, the current is started as soon as the plates touch the solution, and the more the treadle is pressed, the deeper the plates are immersed into the solution; so that by the pressure of the foot, the operator can regulate the battery supply, and consequently the speed of the motor, to suit the work.

The motor can be adapted to a variety of uses, some of which are illustrated herewith. Fig. 1 shows its application to a lathe in a small workshop. In Fig. 2 is shown a neat arrangement for use in public offices during the heated term. This is a small rotary fan operated by the motor. It is said that it will cause a breeze blowing at the rate of 800 feet in a minute. Fig. 3 shows its application to the propulsion of boats, with a new feature of special interest. The propeller can be shifted in and out of line by simply pulling the rope which turns the wheel and at the same time the frame holding the propeller, consequently the propeller may be made to work in any direction, and thus, without rudder or reversing the motor, the boat can be turned and steered with the greatest accuracy.

New Telephone Wire.

A new iron wire, especially designed for telephone lines, has lately come into the market. Its greatest peculiarity appears to be in a grooved surface. Instead of being round in cross section, as shown at *W* in Fig. 1, this wire has a cross section of the shape represented at *W* in Fig. 2. These depressions or grooves are not drawn in a straight line from one end of the wire to the other, but run in a loose helical twist around the wire, hence its name "spiral wire." Many claims are made in favor of this wire for telephonic purposes, the most important of which is its freedom from inductive disturbances and its application to long lines. The theory on which the elimination of induction is accounted for is that of different distribution of the electricity on the different shape. It is maintained that while in the case of round wire the inductive field is circular and concentric as shown by *B A*, Fig. 1, in the case

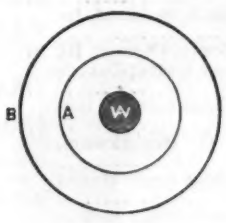

FIG. 1.

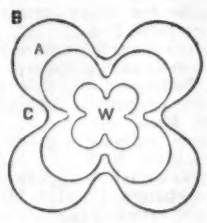

FIG. 2.

of the "spiral wire" the field is unevenly distributed, at shown by *B A* Fig. 2, and that a wire placed at *C* would in one case be comparatively free from inductive influences while it would be acted upon at a distance beyond, since by the helical turn of the groove the portion *A B* of the field would be brought into action. Thus there would be a succession of inductive "nodes" all along the line, the resultant action of which, it is claimed, is a neutralization of all induction currents. The experiment is said to have proven entirely successful on lines of various lengths, from five to twenty-five miles, and it is claimed that the longer the line the freer it is from induction. These two figures are rather ideal, however, and fail to give the real distribution of the inductive field; for we must recollect that the iron of the wire is a magnetic metal, and reacts on the distribution of the lines of force of the current. Still, the theory is plausible enough, that a change of form would involve a change of distribution of the inductive field, and it seems strange that the matter has not been taken up before. In our opinion, the wire deserves a fair trial. It is manufactured by the American Spiral Wire Company, Boston, and is advertised in another part of this paper.

Professor Morton's Lecture.

The lecture by Prof. Henry Morton, before the members of the Electrical Society, at Hoboken, last Friday evening, attracted a large audience. The lecture was of absorbing interest throughout, and passed on in a highly interesting and entertaining manner from the fundamental principles of storage batteries to their latest developments. For the occasion the lecture room was brilliantly illuminated by Edison lamps, with shades of various colors, the effect being strikingly beautiful. These lamps were supplied from a battery of Sellon-Volkmar accumulators, made in London, and which have been at the Institute for several months. The lecturer treated the subject in a popular yet thoroughly scientific manner, and the experiments which he called to his assistance in discussing his theme were as novel as they were convincing. We regret that our limited space forbids an extended notice of the lecture in the present issue. It uncovered many new and most important points, which throw considerable light on this branch of the science, and at the same time the results which Prof. Morton advanced were of the most convincing value. We shall take an early occasion to refer more at length to the interesting features of this lecture, for we believe them to be worthy of much attention and study.

Efficiency of Storage Batteries.

At the meeting of the National Academy of Sciences, held in Washington, Friday, April 20, a paper by Prof. Geo. F. Barker, on "The Efficiency of Storage Batteries" was read. This paper was received with much interest, because it revealed several important conclusions that are somewhat in opposition to the generally accepted opinions of electricians. Among other things, Professor Barker states that some material better than lead must be found for the positive plates of storage batteries, and he shows also that thin plates are far better than thick ones, in spite of the fact that electricians generally have worked under an opposite impression. Professor Barker's name is authority in matters relating to storage, as was shown in his lecture on the subject at the last meeting of the American Association for the Advancement of Science, held at Montreal in August 1882.

The Vienna Electrical Exposition.

At the instance of the Austrian ambassador at St. Petersburg, the Emperor of Russia has granted the sum of 15,000 rubles ($12,000) to the Russian Imperial Technical Society of St. Petersburg for the formation of a Russian department at the Vienna Exposition. Mr. Welitschko has been placed at the head of the commission. This is a handsome little provision for the representation of a country which has scarcely contributed anything since the days of Jacobi to the development of the science. If the United States were to have had as fair an appropriation in comparison to the place they hold before the world in electrical invention, the prospects of their being conspicuous by their absence at this exposition would not be so great.

Progress of the Fuller Electrical Company.

The Pennsylvania Electric Light Company has, after examination of the different electric lighting systems, adopted that of the Fuller Company, and an installation of one hundred lights has lately been shipped to the capital of the Keystone State, as the first step in its business career.

Mr. Fred R. Place, of Hot Springs, Ark., has secured the agency of the same company for the State of Arkansas, and is about introducing the increasingly popular modern improvement, the electric light, into that great and growing State.

The Dayton Electric Light Company has lately ordered an additional installation of one hundred and twenty of the Fuller standard lights for use in connection with the large plant already in operation in that beautiful city of Southwestern Ohio.

The focusing lights and reflectors of the Fuller Company are serving a very useful purpose, and becoming popular in connection with steamboat service, and for the illumination of wharves and docks, on the great lakes and rivers of the West.

The Fuller Company has lately applied to the Common Council of the City of Brooklyn for permission to establish a system of general illumination for the streets, stores and other business buildings throughout the principal streets of the city.

THE ELECTRIC LIGHT.

NASHVILLE.—The United States Electric Light Company will soon establish a local company at Nashville.

A LARGE HEATER.—At the Pacific Boiler Works there is building a 500 horse-power heater for the Maxim Electric Light Company, Philadelphia, Pa.

CHICAGO.—The foundations for the Western Electric Light Company's new works in Chicago, are being laid. The factory, which is to be 250x50 feet, is to cost $80,000.

A PROGRESSIVE CITY.—The city of Boston has appropriated $83,000 for electric lighting this year. This is the largest appropriation ever made by any city in this country for that purpose. The Brush Electric Light Company, of Boston, expects to get most of this lighting.

BUILDING A RAILROAD BY ELECTRIC LIGHT.—The West Shore Railroad contractors are using the electric light for night work in the vicinity of Newark, Wayne County, N. Y. As soon as the ground is soft enough to admit of plowing and scraping, the electric light will be used through Monroe County.

THE SUN CAPITULATES.—The installation of 200 Edison lamps in the offices of the New York *Sun* is a notable victory for the Edison Company, as one of the principal owners of that journal is a heavy holder of gas stocks, and it has been the chief opponent of Edison's system. It has had an article this very month insisting that electric lighting was a failure.

A DESTRUCTIVE FIRE.—On April 21 a serious fire took place in the building of the Brush Electric Light Company in Cincinnati. The damage is estimated at from $40,000 to $50,000, and the company will be unable to furnish light to its customers for perhaps a month. During the floods in Cincinnati the gas lamps failed, but the electric light took their place. Now the gas will have an opportunity of returning the compliment.

ANOTHER BRUSH DIVIDEND.—The Brush Electric Company, of Cleveland has declared another dividend of one and a half per cent., payable now. The company's elegant new buildings are nearly completed, and will be devoted mainly to the manufacture of storage batteries. The first lot of batteries will be placed in the market during the first of May, and will be readily disposed of, as many orders are now awaiting to be filled.

ELECTRIC LIGHT WIRES IN PITTSBURGH.—The Fire Marshal of Pittsburgh, Pa., in his annual report, says he has examined all the electric light lines as they run through the city, also the lamps as arranged in buildings, and finds them to be perfectly safe, He compliments Superintendent S. A. Duncan, of the electric light company, on the care and skill employed in arranging the wires and lamps. Mr. Duncan was formerly a chief operator in the Western Union office at Pittsburgh.

THE BERNSTEIN LIGHT.—The Bernstein Electric Light Company, of Boston, has lately made an installation of its apparatus in the Boston Post-office building. In the driveway and in the weighing room, sixteen lamps have been fitted up of 30 candle-power, nominal, and the results are said to be very satisfactory. No details have as yet been made public as to the peculiarities of the Bernstein generator, which is said to be a novel invention, and no data have been obtained as to its efficiency.

ELGIN, ILL., TO BE LIGHTED.—The City Council of Elgin has contracted with Mr. George S. Bowen, of that place, to erect seven tubular iron towers, one to be 150 feet high, and six to be each 125 feet in height, and to place upon them a total of twenty-three Brush electric lamps of not less than 2,000 candle-power each, or some other light equally as good. Mr. Bowen agrees to produce, operate and maintain for five years an electric plant for $6,800 per annum, and $300 per year for each additional lamp that may be ordered. The city is to have the privilege of buying the seven towers at any time for $7,300. The contractor has four months in which to get the electric light in working order, but he thinks it can be done and Elgin illuminated within three months.

APPRECIATION OF THE ELECTRIC LIGHT.—The Baltimore *Sun* speaks in terms of high praise of the Edison lights in use in the offices of that journal. It says: "The *Sun's* new dynamo machine, weighing nearly five tons, has just been received. It contains all of Edison's latest improvements and will give about 80 per cent. more light than the machine now in use, which it replaces. The *Sun* iron building, with 250 Edison lamps run from this dynamo, will be second in brilliancy to no building in the world. As summer approaches the exemption from the great heat caused by burning gas will be a boon to the great number of busy employés that are through the night actively engaged in bringing the paper in all its details to perfection for its thousands of readers in the morning. The ready way in which the light is turned off and on, and the fact that no matches are required for lighting up, are among the very numerous advantages which the light has over the old system of gas."

TELEPHONE DEPARTMENT.

CINCINNATI.—The telephone has brought 130 villages within speaking distance of Cincinnati.

INCORPORATED.—The Egan Telephone and Electric Company, of Ranesville, Ohio, capital stock $100,000.

The Electric Message Company of Belleville, Ill., capital $5,000. Incorporators—W. W. Waugh, Benjamin J. West and F. H. Pierper; and the Heisler Electric Bell and Burglar Alarm Company, of St. Louis; capital $20,000. Incorporators—Charles Heisler, James S. Garland, Nathan M. Heisler, and Jacob Cloes, St. Louis, Mo.

BIRMINGHAM, ALA.—Mr. D. B. De Forest has been appointed manager of the Southern Bell Telephone Company's office here. The local paper says that the company could not possibly find a better manager than Mr. De Forest.

THE ROSEBURGH SYSTEM.—Mr. George Black, of Hamilton, Ont., has been at Tottenville, Staten Island, for about a week, superintending experimental tests by which messages by telegraph and messages by telephone can be transmitted simultaneously over the same wire. The tests are said to have been very satisfactory.

A SANGUINE VIEW OF IT.—A Georgia "Judge," considering the developments of the telephone, believes the time will come when its principle will be applied to the other senses, and a man can sit down in Atlanta, see a theatrical representation in Cincinnati, smell a bouquet in New Orleans, taste a fresh oyster in Baltimore, and shake hands with a friend in Savannah all at the same time.

THE TROPICAL TELEPHONE CO.—A telegram from Boston says that on April 20 the Tropical Telephone Company closed a contract by cable with the National Electric Company of Brazil, which will yield a cash income of $30,000 to the company and also 20 per cent. of the capital stock of the Brazil Company, or $100,000. An executive committee was elected, consisting of the president, vice-president and secretary, the vice-president to act as general manager.

A NEW TELEPHONE.—A Youngstown, O., paper says that Dr. N. B. Acheson, presumably of that place, has applied for a patent on a novel improvement to the telephone system. With even the best telephone, it is often difficult to hear the aspirates, no matter how distinctly spoken. The device of Dr. Acheson, which is simple in construction and can be easily attached to a transmitter, obviates the difficulty mentioned, rendering every letter clear and distinct. A telephone expert has examined it, and pronounces the invention perfect.

RAPID TELEPHONE CONSTRUCTION.—Andrew G. Haines took a gang of three men from the City of Mexico to the city of Oaxaca, in the State of Oaxaca, Mexico, in March last. On the 15th inst. he writes: "We now have 51 subscribers connected with our central office, after being on the ground less than six weeks. The opening of the exchange was celebrated by the merchants and others, and champagnes, wines, fruit, etc., were sent to our office in great quantities." Mr. A. G. Haines is the youngest of the Haines Brothers, who are so well known in their enterprises of promoting telegraph and telephone companies.

PROFESSOR BELL'S RECEPTION.—The reception given at Washington on the 19th inst. by Mr. and Mrs. Alexander Graham Bell in honor of the National Academy of Science was one of the handsomest of the season. It was the house-warming of Bell's new residence, which was postponed from last winter on account of the serious illness of Mr. Bell's little child. His house on Scott circle is one of the most elegant of a large neighborhood of elegant residences. Over 600 invitations were issued. The centerpiece of the supper table was an immense floral bell, and at either end was a representation in flowers of a telephone.

TOLEDO, O.—Mr. H. N. L. Bernard, who resigns the management of the Toledo exchange to accept the position of division superintendent of Indiana, was presented by the employés of the exchange with an appropriate expression of their good will on Saturday last. Mr. F. F. Graves, of the Sandusky exchange, succeeds Mr. Bernard as manager at Toledo. The material for the line to connect Toledo and Fremont is on the ground and work is about to be commenced. This will give Toledo connection, through the Fremont exchange, with Clyde, Fostoria, Port Clinton and other towns.

AN IMPORTANT TELEPHONE MEETING.—A meeting was held at Davenport, Iowa, on the 21st inst., of stockholders of the Midland, the Central and the Western Telephone companies. The outcome of the meeting, which was private, is said to have been that the representatives present favor a grand consolidation of these three companies, controlling Ohio, Indiana, Illinois and Iowa. One-third of the consolidated stock will be sold to the Bell Telephone Company, as a guarantee that the stock will not pass into other hands, which may be opposed to the Bell people. The Western Telephone Company has now exchanges in some fifty towns, such as Muscatine, Clifton, Lyons, Iowa, and Coal Valley, Milan, Rock Falls, Sterling, Geneseo, Cambridge, Rock Island and Moline, Ill. The other companies, the Midland and the Central, are also working numerous toll lines. A stockholder of the Iowa Telephone Company states that the company is likely to go into the consolidation. It is agreed that the new company may buy and manage any independent lines and small companies which are now or which may be organized.

A ST. LOUIS DECISION.—It seems there is at least one city where telephone companies are allowed to have some rights. The Court of Appeals at St. Louis has just affirmed the decision of the lower court in favor of the Bell Telephone Company of Missouri, in the suit brought by the Julia Building Association, of that city, for an injunction against the telephone company. The plaintiff had, with the knowledge and consent of the city officials, extended the basement of a building so that the retaining wall was under the street, beyond the sidewalk. The telephone company, under a concession from the city, commenced cutting holes through the sidewalk flagging, just within the curb, for the poles, which descended into the retaining wall of the basement to the depth of seven or eight feet. The plaintiff alleged that the poles and wires would be detrimental to its business and property, and the insertion of the poles would weaken and injure the walls and reduce the rental value of the property. In reviewing the case the appellate court held that the concession made to the plaintiff was in the advancement of a mere private interest, while the subsequent concession to the defendant corporation was a dedication to the welfare of the public, and that the concession to the telephone company was in effect a revocation of the prior concession to the plaintiff. The injunction was therefore refused.

THE "SECRET" TELEPHONE FOR MAKING EAVESDROPPING IMPOSSIBLE.—The National Secret Telephone Company claims that it can insure the transmission of messages between the sender and the receiver in such manner that they cannot be taken off from the wire by induction or by cutting in and tapping the wire. To effect this the impulses from the transmitter are divided and transmitted over two independent lines of wire, one-half passing over one circuit and one-half over the other, and at the receiver are gathered up, adjusted in their proper order, and from a single wire articulated in distinct words. This division of the impulses is effected by a switch, operated by a very rapidly revolving, small electric motor, which opens the wires alternately to the current. Thus the word Constantinople, for instance, sent in secret, would go over the wires alternately in something like this shape:

C n a t o e
o s t n i n p l

and could be patched into understandable form only by passing, in order of its sections, into the receiver. To the ear of a person tapping the wire the message sounds like nothing more than a meaningless buzz.

In practice it is not expected that the secret system will be generally employed except by brokers and others whose business is necessarily of a private nature, and the double lines will be put in for it only when they are expressly desired. For these one electric motor at the central office, or telephone exchange, will suffice to issue secrecy on all lines connected with the central office. Private lines will require an electric motor at one end to do the switching of the current. Mr. Randall and the directors of the company believe that the power of their instruments will enable them to work through underground wires and properly insulated cables.

MISCELLANEOUS NOTES.

STILL PROGRESSING.—A representative of the firm of J. H. Bunnell & Co. sailed for Europe on Saturday last. While there he will endeavor to arrange, on behalf of Messrs. Bunnell & Co., for the general agency in this country of some of the English electrical specialties.

AN ORDER REVOKED.—The order mentioned in our last issue as having been issued placing on the list of frauds the Portable Electric Light Company, of 22 Water street, Boston, has been revoked by Postmaster General Gresham, on the ground that the article advertised for sale is patented, and cannot therefore be classed as a fraudulent device.

A NEW STAGE EFFECT.—A novel application of electricity in the production of stage effects was introduced in the Bijou Theatre, Boston, on last Thursday, in the first presentation of the comic opera of "Pounce & Co." In the second act a number of silk looms are represented as being in operation, the power being furnished by an Edison electric motor.

THE PARIS COMMISSIONERS.—Professors Trowbridge, of Cambridge, Mass., Rowland, of Baltimore, and Barker, of Philadelphia, visited the Department of State at Washington on the 19th inst., to arrange the details of the electrical experiments to be conducted on the part of the United States with reference to the international conference to be held at Paris next October. It was arranged that Professor Rowland should conduct the experiments to determine the standard of electrical resistance, Professor Trowbridge the experiments relating to atmospheric electrical disturbances, and Professor Barker those which look to the determination of a standard of light.

TWO LEARNED JUDGES.—To illustrate the wide range of authors from whom judges of courts are sometimes forced to draw in explanation or confirmation of their opinions, Judge Reid, of the Superior Court, at Frankfort, Ky., in the decision reversing the case of T. J. Sullivan vs. J. A. Kuykendall, from Warren County, in reference to a contract involving $800, and dependent on a message claimed to have been delivered by telephone, says: "He was not accustomed to the use of the instrument, or, in the language of Uncle Remus, was unable to holler in the box and thus leave his remarks." Judge Bowden not long ago having drawn from Hoyle, should suggest to the Librarian the necessity of buying "Hoyle on Games" and "Remus on the Telephone" as reference books for the courts and bar of the State.—*Cincinnati Commercial-Gazette.*

STOCK QUOTATIONS.—Telegraph, telephone and electric light stocks were quoted on Wednesday of last week and Wednesday of this week as follows:

	April 18.	April 25.
Western Union Telegraph	83⅛	82½
Mutual Union Telegraph	20	20⅛
American Cable	66¾	66⅝
American District Telegraph	33	33
Edison Illuminating Co.	55	58
Underground Electric Cable	55	....
U. S. Electric Light	....	128
Shaw Telephone	....	40
Mexican Telephone	3¾	3⅝
Tropical Telephone	2⅛	2⅞
American Bell Telephone	225	225
Northern Telephone	145	....

DEPARTMENT OF INQUIRIES.

CONNECTIONS OF TELEGRAPHIC APPARATUS IN A WAY STATION.

Please tell me how to connect an instrument with telegraph lines—not how to open an office, but how to connect a passing line with an instrument. W. W. W., MYERSTOWN, Pa.

The line is cut and the two ends are brought into the office or place where the instruments are to be used by means of "leading in" wires, generally of copper because it is more pliable and easy of handling. The connections are made so that the current on the main line may pass from one leading in wire to the key and from the key to the electro-magnet of the relay and thence to the other leading-in wire. That is to say, the key and the magnet of the relay are included in the main circuit. No ground is necessary if the circuit is closed at both ends of the main line. The sounder is placed in the circuit of a local battery of a few cells, together with the make-and-break of the relay. In other words, every time the armature of the relay moves it should act upon the local circuit so as to cause the sounder to repeat every signal passing on the main line.

THE BLAKE TRANSMITTER AND LONG-DISTANCE TELEPHONY.

Why will one cell of battery on a "Blake" talk better than two or more, and why will it not talk on long-distance lines? If one cell talks plainly, say fifty miles, why would not two cells talk plainly a hundred miles? What is the difference between a Blake and a long-distance instrument? What is the longest distance over which a Blake transmitter has ever been used?

J. W. L., Paris, Ky.

The Blake transmitter, or indeed any form of the microphone, performs its functions by causing variations of resistance with the primary circuit, for it is plain that when the diaphragm is vibrating the carbon buttons are alternately in closer and in looser contact. The difference may be equal to several ohms. The transmitter is nothing more, in fact, than an instrument which adds resistance to the circuit for a brief instant, and takes it off for an equally brief period; and as less current passes when the resistance is greatest and more when the resistance is least, a fluctuation arises in the circuit, and the current is said to be "wavy" or "undulatory." Now the distinctness of the articulation depends on the distinctness of these waves. It is important, therefore, that they should be as marked as possible, and consequently the more sensible the variation of the current by the change of resistance at the carbon buttons, the better; it is here that the advantage of using one cell is plainly seen. A resistance of three or four ohms introduced in a circuit of fifty cells and taken off again would scarcely make any impression; but as we diminish the number of cells, the effect becomes more and more striking, until with one cell it is very apparent. The electromotic force of the secondary impulses that go over the line depends in great measure on the abruptness of the waves in the primary circuit, and if the transmitter is not adapted to produce very great fluctuations of resistance at the carbon buttons, then it will not be able to transmit beyond a certain distance. This is the reason why the Blake transmitter has not been able to work beyond about four hundred miles—the greatest distance over which it has worked successfully. In the recent long-distance transmitters the contacts are very delicate and so arranged that the same vibration makes a greater variation of resistance than with the Blake, so the action in the induction coil is more energetic, and the electromotive force of the induced impulses is higher, and consequently their distinctness is greater. The main obstacle to contend with in long distance telephony is the phenomenon of retardation in the impulses, and that is the reason why they should be sharp and well defined, that they may not merge into each other by the retardation or prolongation.

MAKING CARBON PLATES.

How can I form common carbon (that obtained from gas-works) into plates? I have occasion to use a great deal of it and find it difficult to "grind down." There is a way of preparing it so it can be pressed into the desired shape, is there not?

J. W. C., Massillon, O.

There are many methods of preparing carbon rods and carbon plates, and the various manufacturers of carbons the world over have all their own little secrets, to which they ascribe the peculiar merits of their products. To a certain extent, however, they all seem to proceed in the same manner. The carbon is ground or pulverized to an impalpable fineness, the fine grain of the carbon plate depending largely on this step. As a paste, M. Carré, whose fame is established in this connection by the superior carbons which he makes, uses a mixture of thirty parts of cane sugar and twelve parts of gum, properly dissolved. The carbon powder is then mixed with this syrup and the mixture subjected to strong pressure in iron molds, or, in making electric light carbons, it is forced out through a die by hydraulic pressure. The molded carbons are then laid horizontally in layers in a crucible, usually of iron, sufficient space being left for a layer of powdered carbon and a layer of sand, over which the cover is fastened. They are then subjected to a cherry-red heat in this crucible for four or five hours, and afterward kept two or three hours in a boiling solution of sugar, though they are taken out and allowed to cool two or three times, so that the syrup may more easily penetrate into the pores. After washing in water, they are dried slowly for fifteen hours in stoves, after which they are again calcined in the crucible and once more boiled in syrup, the process being repeated three or four times, or until the proper density has been attained.

EDISON ELECTRIC METERS—COMMUTATOR SPARKING.

(A) What kind of meter is used in the Edison electric lighting system in New York to ascertain the amount of electricity consumed by each customer?

(B) Are there any dynamos that do not spark at the commutators?

G. W. N., New York City.

(A) The Edison electric meter depends on the fact that, in an electroplating bath the amount of metal dissolved or deposited by electrolysis is directly proportional to the amount of current passing, and to the time of duration of the experiment. Thus if, when a current of the strength of one ampère is passed for one hour between two zinc plates in a zinc sulphate solution, the amount of zinc dissolved from the positive plate, or anode, and deposited on the positive plate, or cathode, be equal to 1.336 milligrammes, then the amount transferred by a current of twice this volume, or acting for two hours, will be twice as great, and the amount transferred with a current of half the volume, or acting for only half the time, will be only one-half as much. Edison's meter is, in fact, made up precisely of two amalgamated zinc plates in a solution of zinc sulphate. There are two such meters at each place, one being intended as a check upon the other. They are each placed on a shunt or derived circuit from the conductors leading to the lamps in the house, the resistances being proportioned so that only a small known portion of the current passes through each meter on its way to the lamps, the amount passing through one meter being, however, four times greater than that passing through the other. Whenever the current is used in the lamps, it causes the electroly in each meter, whereby one plate gains in weight while the other loses an equal amount. At convenient times, these zinc plates are weighed. The amount of zinc deposited, in milligrammes, divided by 1.336, will give the number of "ampère-hours" of action in the cell, and if each cell has worked properly, the results will be four times larger in one. As these ampère-hours represent only a fraction of the whole current which has passed, say one-hundredth, and one four-hundreth, they have to be multiplied by their respective resistance ratio to give the true total. There are, of course, a few particularities of details, some of which are quite important; for instance, the introduction of a small resistance coil whose increase of resistance by heat may balance exactly the *decrease* of resistance of the solution itself, by heat.

(B) There are no dynamo electric machines known which are not liable to spark when the conditions of normal working are not present. The subject of commutator sparking will be found treated in "Electric Lighting, XV." in No. 6 of the present volume of THE ELECTRICAL WORLD.

ELECTRICAL PATENTS ISSUED

And dated Tuesday, April 17, 1883.

Apparatus for covering telegraph cables; John Roberson, Brooklyn, N. Y.	275,859
Cylinder for rotary armatures; James F. Gilliland, Indianapolis, Ind.	276,024
Dynamo electric machine; Wensel Morava, Chicago, Ill.	276,063
Electric signaling apparatus for railway trains; George M. Bedinger, Jr., Erlanger, Ky.	275,879
Electric pneumatic railway signals; Oscar Gassett, Boston, Mass.	276,021
Electric railway signals; Stephen C. Hendrickson, Brooklyn, N. Y.	276,038
Electric signaling apparatus for telephone lines; Daniel Drawbaugh, Eberly's Mill, Pa.	276,136
Electric interlocking switch and signal; Oscar Gassett and Israel Fisher, Boston, Mass.	276,138
Galvanic battery; William A. Alexander, Mobile, Ala.	275,797
Galvanic battery; John B. Odell, Chicago, Ill.	275,845
Incandescent electric light; Thomas L. Clingham, Asheville, N. C.	276,133
Speed regulator and reversing device for electric motors; Eusebius J. Molera and John C. Cebrian, San Francisco, Cal.	275,842
Secondary battery; Charles F. Brush, Cleveland, O.	275,985-6
Storage or secondary battery; Charles J. Van Depoele, Chicago, Ill.	276,099
Telegraphic relay; Joseph P. Smithers, Brooklyn, N. Y.	276,087
Telephone transmitter; Daniel Drawbaugh, Eberly's Mill, Pa.	276,137

BUSINESS NOTICES.

Among other new advertisements which appear in this issue will be found that of the Repauno Chemical Company, under which title have been consolidated the high explosive interests of the Hazard Powder Co., the Laflin & Rand Powder Co., and Messrs. E. I. Dupont De Nemours & Co. Each of the respective companies named have been so long and favorably known throughout the country that the consolidation thus represented requires no indorsement of ours. The intention of the new company to establish its agencies in the leading countries of South America, Australia and other foreign lands, will be an index not only of its strength and enterprise, but also of its determination to contest the field at large with foreign as well as domestic competitors. The company is under the general management of Mr. S. T. Apollonio.

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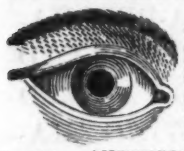

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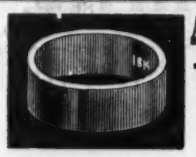

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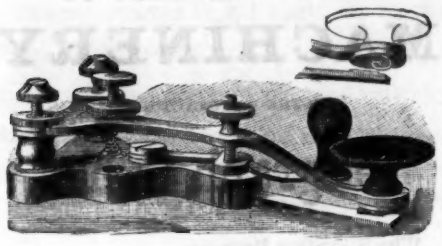

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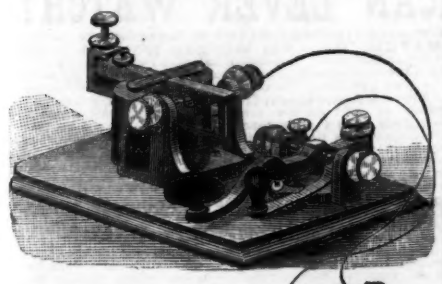

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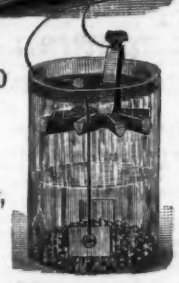

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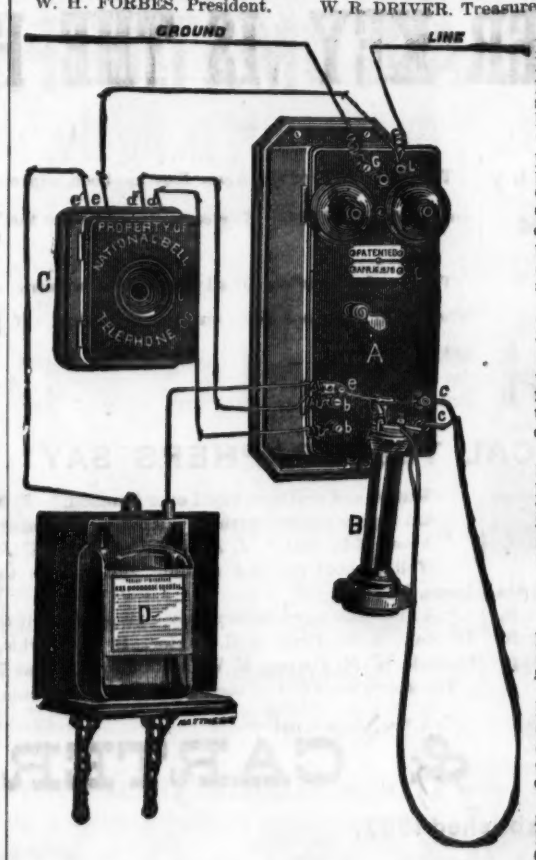

This Company, owning the Original Patents of Alexander Graham Bell for the Electric Speaking Telephone, and other patents covering improvements upon the same, and controlling, except for certain limited territory, under an arrangement with the Western Union Telegraph Company, the Gold and Stock Telegraph Company, the American Speaking Telephone Company, and the Harmonic Telegraph Company, the patents owned by those companies, is now prepared to furnish, upon application, either directly or through any of its agents, Telephones of different styles, and applicable to a variety of uses.

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In order to advertise **HOUSE AND HOME**, and secure subscribers promptly, we have decided to make the following most princely and magnificent offer to each and every reader of this paper. It is the common practice of the gold and silver refiners of England and Switzerland to purchase from the pawnbrokers of their respective countries all the gold and silver watches which have been surrendered, simply for the sake of the gold and silver cases. The works are then sold to a celebrated watch firm who have made a specialty of this business. The firm places the works in the hands of skillful workmen, who set to work and put them in as good condition as possible. These works embrace every variety of movement, some of them being very fine and perfect timekeepers, all handsomely cased. *We have just purchased the entire stock* (25,000) *of a bankrupt concern of the above described watches at less than the first cost of the raw material.*

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WHAT THEY SAY OF US.

West Point, N. Y., Oct. 17, 1882. Metropolitan Publishing Company. Gents.: I am in receipt of the handsome premium watch sent me. I was much surprised to know that you could supply so good a timekeeper for so little money. HOUSE AND HOME alone is worth the price. Enclosed please find six (6) new subscriptions at $2.50. Please send me 6 premium watches, the same style as the last. Very truly yours, Lieut. E. S. Farrow, U. S. Army. **Murfreesboro, Tenn.,** Sept 30, 1882. Gents.: Watch arrived. * * * All right in time keeping qualities. Jesse W. Sparks, Jr. **St. Paul, Minn.,** Sept. 14. Premium received, and a nice one it is. Gen. R. W. Johnson. **Wrightstown, Minn.,** Sept. 20, '82. Received premium last night. Well satisfied. Martha Goodale. **South Gardiner, Me.,** Dec. 24, '82. Received watch and paper; like them much; was offered $10 for watch; don't want to sell. H. C. Goodwin. **Waverly, Pa.,** Feb. 16, '83. Received the beautiful premium watch. It keeps good time; our jeweler pronounced it coin silver. M. M. Hufford. Testimonials like the above received every day.

N. B.—The popular and beautiful weekly publication known as HOUSE AND HOME, illustrated newspaper (established 1880), **is one of the best and most elegantly illustrated weekly newspapers of the day, full of News, Art, Science, Fashion, Music, Poetry, Charming Stories, Wit and Humor, Useful Knowledge, and Amusement for every American home. In fact, a pictorial history of the world from week to week—sixteen pages beautifully illustrated—same size as Harper's or Leslie's illustrated weeklies.**

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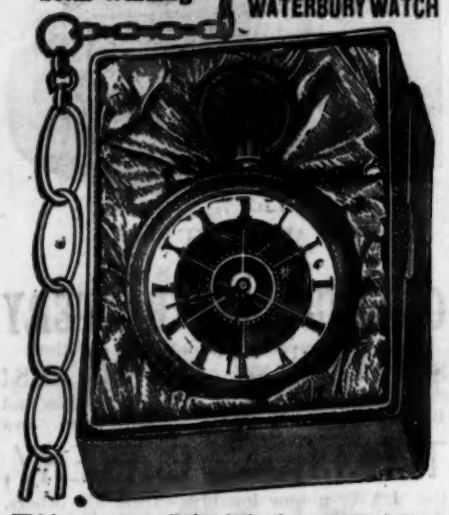

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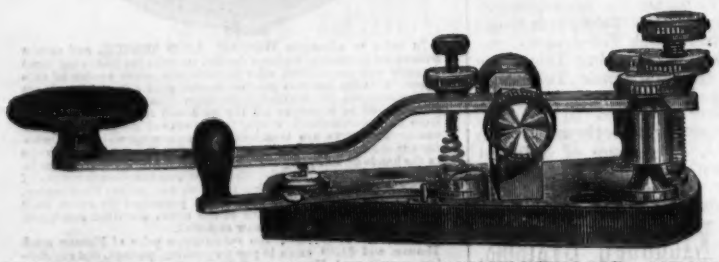

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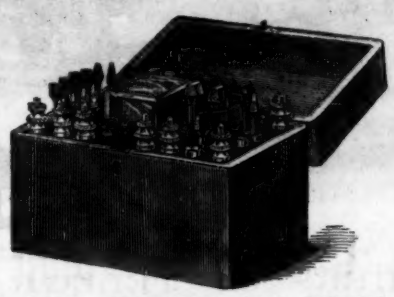

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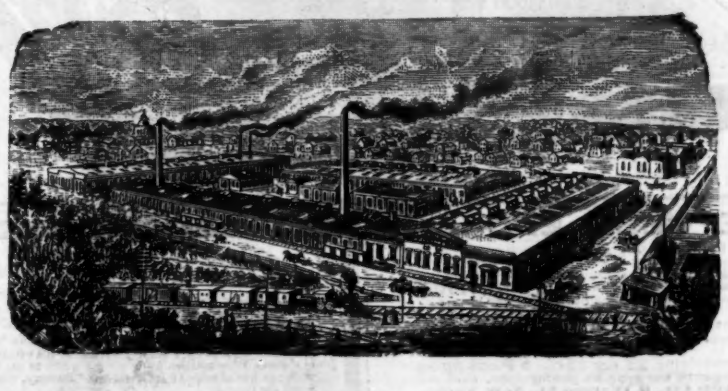

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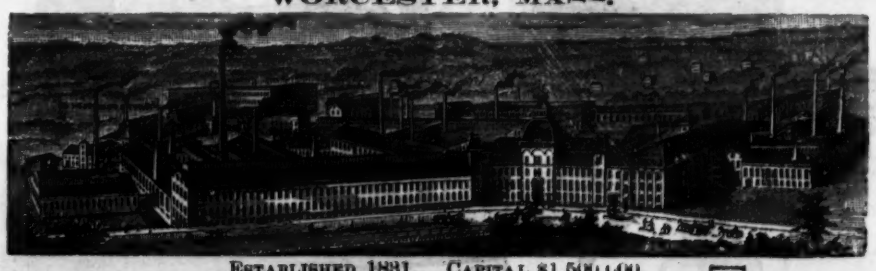

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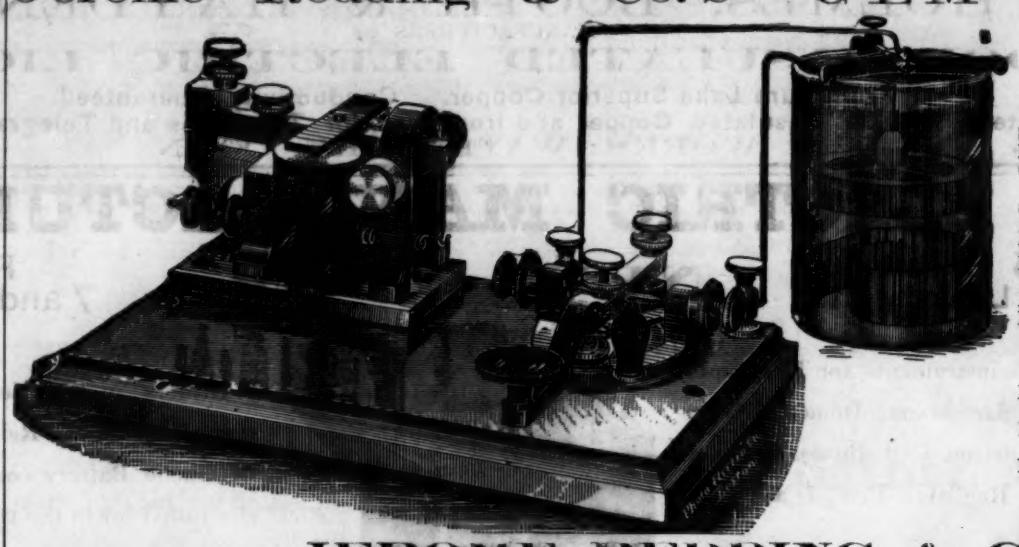

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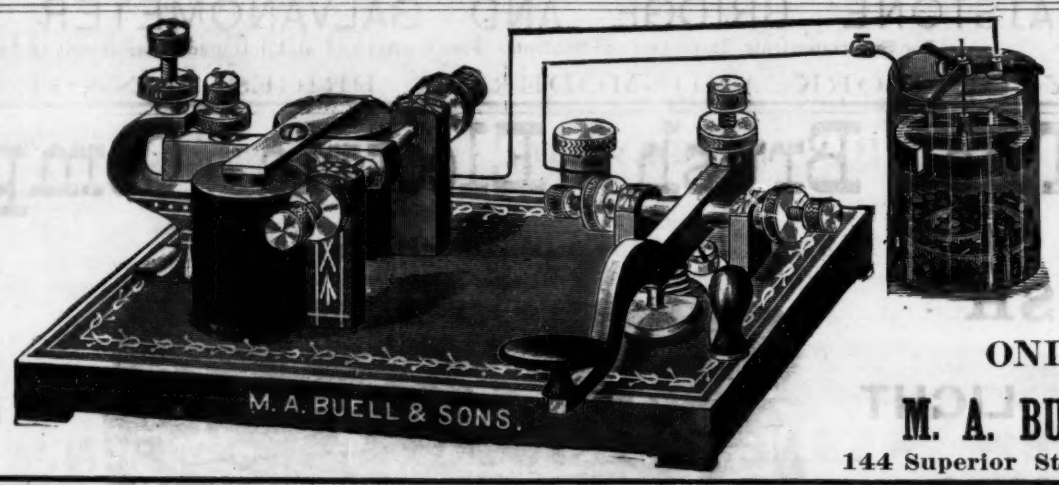

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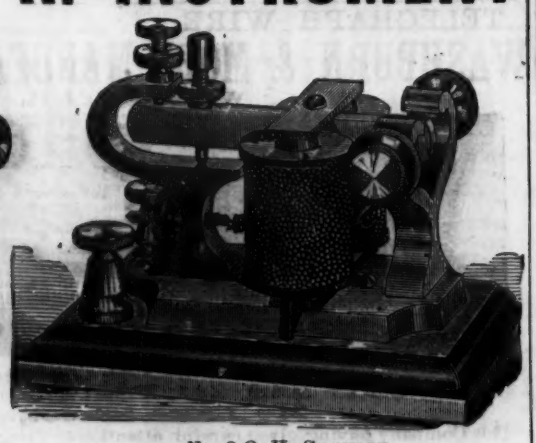

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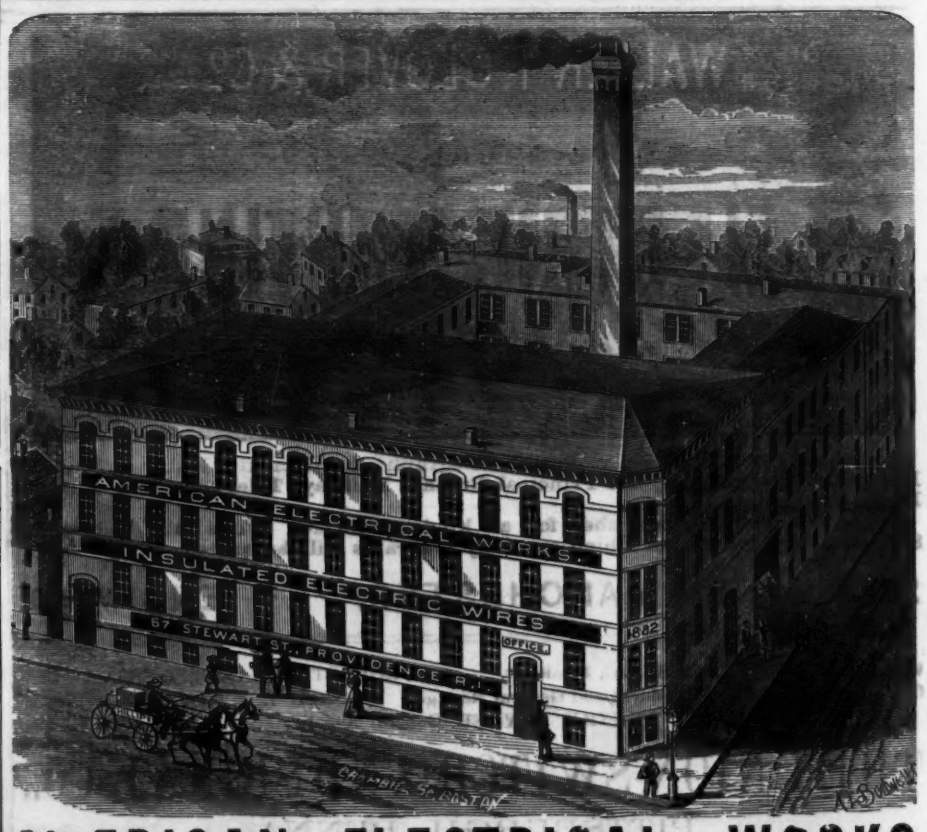

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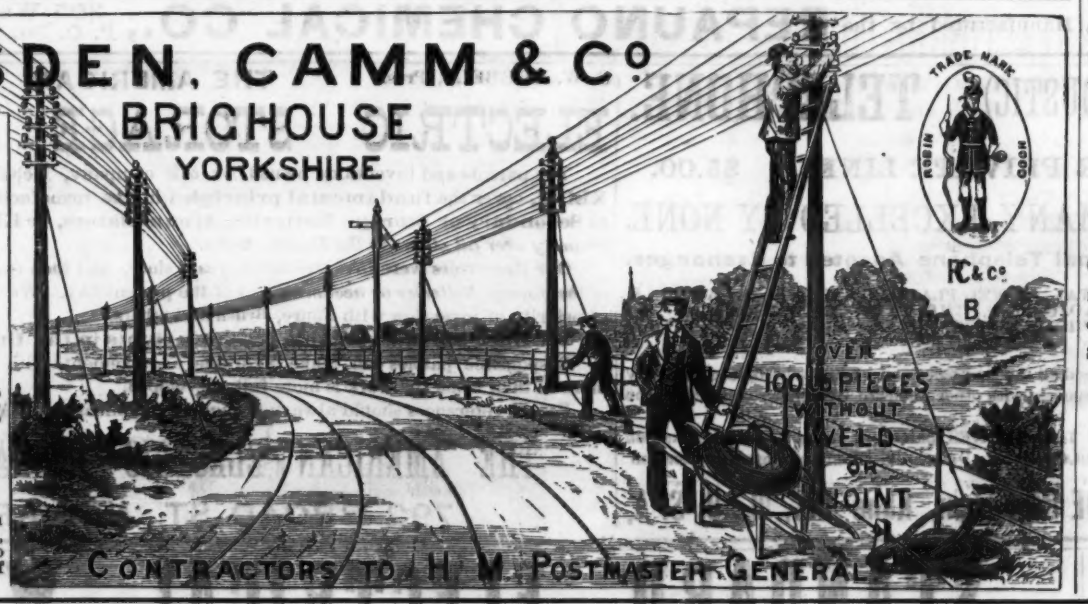

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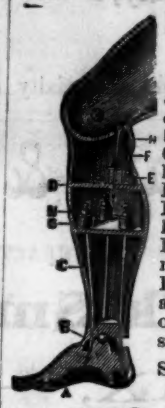

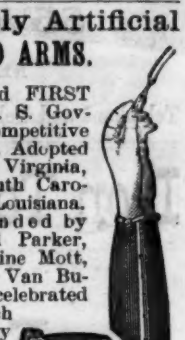

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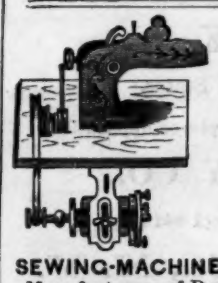

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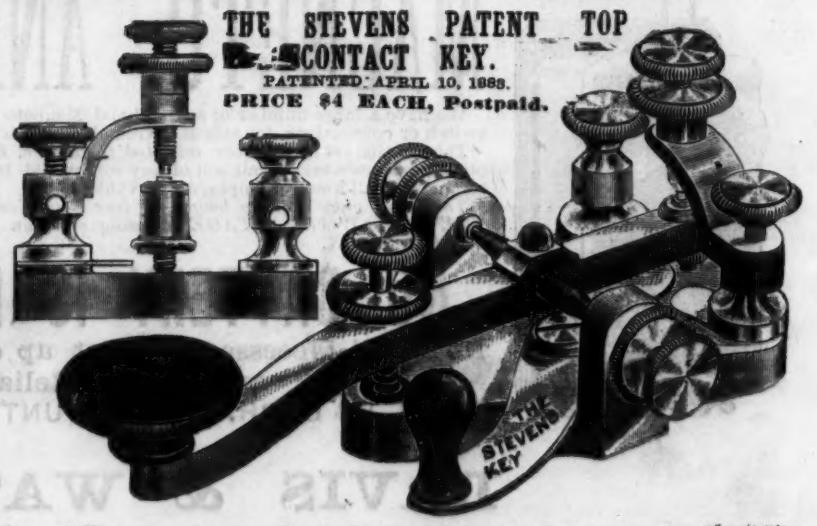

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